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SHOE WEAR AS A MEANS OF ANALYSING ABNORMAL GAIT IN MALES

AN EXPERIMENTAL STUDY

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PATIENTS with abnormal gait necessarily produce an abnormal pattern of wear on the soles and heels of their shoes; in many cases there is also distortion of the uppers. Although examination of shoe wear is well recognized as a useful aid in diagnosing the nature of disorders of gait, there does not appear to have been any critical evaluation of this ancillary method in the literature. The method has therefore been studied in a small series of patients with lesions of the sciatic nerve or its branches. The value of sciatic nerve injuries as a source of material lies in the accuracy with which the extent of the muscular disturbances may be determined. However, it must be admitted that in the long-standing cases of injury which are reported here the picture was often far from simple, being complicated by secondary changes in joints, muscles, and skin. These factors have been fully considered when analysing the pattern of weight-bearing.

In order to test the validity of the deductions made from the study of shoe wear, use has been made of the plastic pedograph already described in detail by one of us (Barnett, 1954). By means of this apparatus the distribution of weight on the various parts of the foot can be studied throughout the stance period of walking on a level surface from the moment of heel contact to that of toeing-off; the exact duration of each

* In receipt of a grant from the Medical Research Council.

successive phase can be measured and the amount of pressure beneath each part of the foot assessed quantitatively.

The principle of the plastic pedograph is as follows: A large number of transparent "perspex" rods are packed vertically within a perspex jacket. The rods stand on a slab of "sorbo" rubber, and when a vertical force is applied are depressed to an extent that depends on the overlying pressure. They are marked in such a way as to allow each rod to be identified precisely. The whole pedograph is inset within a long wooden platform, and high-speed cinematography is used to record the position of the rods during the period they are bearing the weight of a patient who walks steadily along the platform. Each frame of the film is then converted into a pedograph record in which the outline of the sole of the foot is shown, crossed by black bands the width of which at any point is an index of the overlying pressure at that particular moment. Above each outline is a corresponding profile view of the foot and ankle.

The results obtained from the plastic pedograph in normal individuals have been found to correspond with the observations made by Elftman (1934) using a more direct method of recording the pressure distribution. Although it is a somewhat complex apparatus, useful mainly for research purposes, the plastic pedograph has an advantage over most other types in that the part played by the various elements of the foot can readily be determined quantitatively. Thus minor deviations from the normal pattern can be assessed with some assurance.

Material

Out of 270* cases of injury to the sciatic nerve, 129 have been especially investigated by two of us (R. E. M. B. and J. R. N.) over a period extending from 1947 to 1953, to study disturbances of weight-bearing in this type of injury. It is hoped that a full report and analysis of these cases will be published in due course. From this group ten male patients were selected for the present study; nine of them were representative of the four commonest types of muscular imbalance encountered in the larger series of patients. The remaining patient (Case 10) is reported as he presented a particularly interesting problem, a nerve injury having been superimposed on a bilateral congenital deformity.

These ten patients were examined clinically by methods which included those described by Seddon (1954) and by means of the plastic pedograph. This involved a study of at least thirty serial photographs in each case. The phases of the gait are less clearly delimited when shoes are worn, and for this reason pedograph records with the patients walking barefoot

* All the patients were casualties of the Second World War who had received treatment at a special centre and had been followed up systematically at one of the five centres established for the care of peripheral nerve injuries. Records prior to 1947 were available in every case.

have been chosen where possible to illustrate abnormalities in gait. However, when in addition to shoes the patient wears some corrective appliance that alters his mode of gait—for example, a toe-raising spring—it is necessary to use pedograph records of the shod patient for correlation with shoe wear. Pedograph records of the contralateral foot were invariably examined, but no comment will be made unless these are abnormal. For clarity and ease of comparison diagrams of shoe wear have been made from photographs. A summary of clinical observations is given as an appendix to this paper. The findings derived from this limited group are reported, discussed, and illustrated by diagrams of the footwear and selected pedograph records.

Observations

Normal Pedograph Records and Shoe Wear

Before describing abnormal gait and shoe wear a brief account of the normal is required.

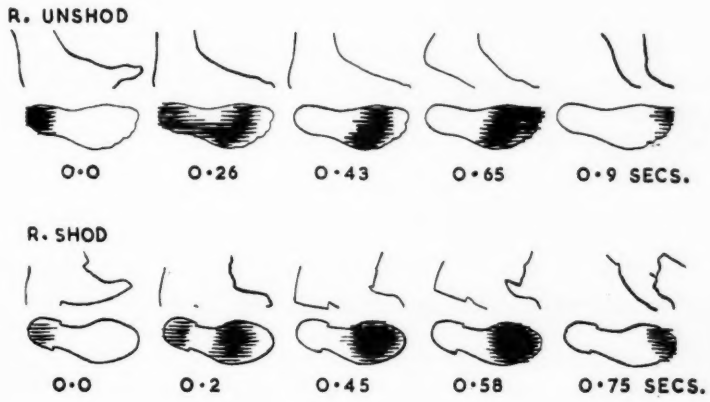

Fig. 1

Unshod and shod pedograph records of normal gait showing the five phases of the stance period.

Pedograph records show that, with respect to the functions of the foot, the stance period of gait can be divided into five phases, illustrated in Fig. 1. In the first, occupying about 10% of the total stance period, only the heel is in contact with the ground. In the second, occupying about 30%, weight is borne by the heel, the lateral border of the sole, and the metatarsal heads. A short third phase, during which only the metatarsal heads are bearing the body weight, is followed by a long fourth phase (about 35% of the stance period) during which weight is borne by the

metatarsal heads and the toes. In the short fifth phase, only the toes remain in contact with the ground.

Features of normal shoe wear are well known but require a brief description here. Clearly, no account can take into consideration the effects of all minor variations of gait in so-called normal individuals. The tendency to in-toe or out-toe during walking (the angle of gait) and the habitual length of stride are two of the factors which are likely to affect the distribution of wear. The following description applies to the large group who walk with the feet slightly divergent (Morton, 1932). For purposes of description the under-surface of the shoe may be divided into segments as indicated in Fig. 2a.

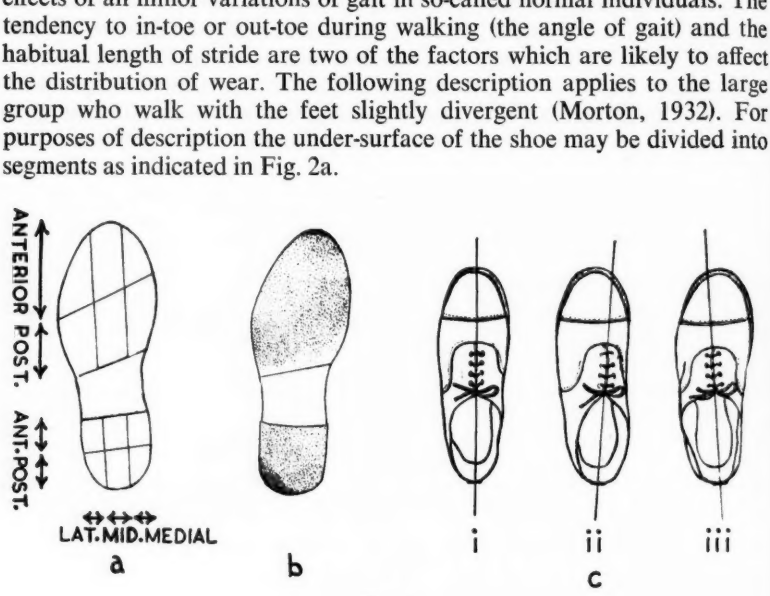

FIG. 2

a. The under surface of a right shoe showing the manner in which the heel and sole are subdivided for descriptive purposes.

b. Diagram indicating the distribution of wear on the heel and sole. The intensity of the stippling is proportional to the degree of wear.

c. i—Uppers of a left shoe worn by a normal individual. The axis of the inlet is indicated. ii—Distortion of the uppers and displacement of the axis of the inlet produced by a plano-valgus deformity of the foot. iii—Distortion of the uppers and displacement of the axis of the inlet produced by a varus deformity of the foot.

The wear on the heel is greater on the posterior than on the anterior half. Maximal wear is situated postero-laterally, while there is usually sparing of the antero-medial segment (Fig. 2b). Wear of the sole is greater on the posterior than on the anterior half. Thus there is a general gradient of wear towards the tip of the shoe (Fig. 2b). The postero-lateral segment shows maximal wear, while on the postero-medial and middle segments the wear is somewhat less marked. On the anterior half wear is maximal on the medial and middle segments. The lateral segment is usually relatively lightly worn, and the extreme outer edge may be spared altogether. The tip of the sole may show excessive wear occurring on

either the medial or lateral side of the mid-line, depending on the precise angle of gait.

Distortion of the uppers provides useful information as to the attitude of the foot which can be assessed by observing the "axis of the inlet" (Fig. 2c). In a pronated (plano-valgus) foot the malleoli are situated more medially than normal with respect to a line joining the middle toe to the centre of the heel (Knowles, 1951). This causes a medial bulging of the upper, leading to a distortion of the inlet. The axis of the inlet is therefore directed medially. (Case 3; Fig. 5.) Flexion creases in the forepart of the uppers provide valuable information as to toe action.

The relative predominance of wear on the posterior half of the heel is explained by the fact that, whereas this part bears almost the entire weight of the body for 10% of the stance period, the anterior half shares the brunt of the body weight with the metatarsal heads. The predominance of wear on the posterior segment of the sole has a comparable explanation, for, while metatarsal contact persists for 80% of the stance period, toe contact occupies less than 40%. The excessive wear on the postero-lateral aspect of the heel is in the region where the heel makes initial contact with the ground (the heel-strike). The excessive wear on the tip of the sole corresponds with the point of terminal contact with the ground (toeing-off) and is brought about by the frictional forces that accompany this phase of the gait.

Abnormal Pedograph Records and Shoe Wear

The patients were classified into four groups according to the type of residual muscular imbalance.

Group I (2 patients).—There was relative overactivity of dorsiflexors and evertors of the foot, coupled with paralysis of the intrinsic muscles of the foot.

Group II (3 patients).—There was relative overactivity of plantar flexors and invertors of the foot. The intrinsic muscles of the foot were active.

Group III (2 patients).—There was relative overactivity of the plantar flexors coupled with paralysis of the intrinsic muscles of the foot.

Group IV (3 patients).—There was paralysis of the intrinsic muscles of the foot. Other muscles were active.

Group I: Imbalance due to Relative Overactivity of Dorsiflexors and Evertors with Paralysis of Intrinsic Muscles of Foot

Case 1: Left sciatic nerve lesion.

Appliances: None. *Frequency of repair of shoes:* Soles—R : L : : 2 : 1.

The unshod pedograph record showed that the main pressure was under the 2nd, 3rd, and 4th metatarsal heads and that the toeing-off phase was absent.

In shod records, pressure was shown under the whole heel initially, becoming maximal on the medial side just before the heel was raised. The wear of the left heel was within normal limits, although it extended a little more medially on the left than on the right. Wear on the left sole was located centrally in accordance with the pedograph records. The absence of wear on the anterior part of the sole corresponded with the absence of the toeing-off phase in the pedograph record. A plano-valgus deformity, most marked on the left, had also produced a slight distortion of the uppers, the axis of the inlet was directed medially. The toe crease was present in both shoes, but was less pronounced on the left; on this side the flexors and extensors of the toes were active but weak. (Fig. 3.)

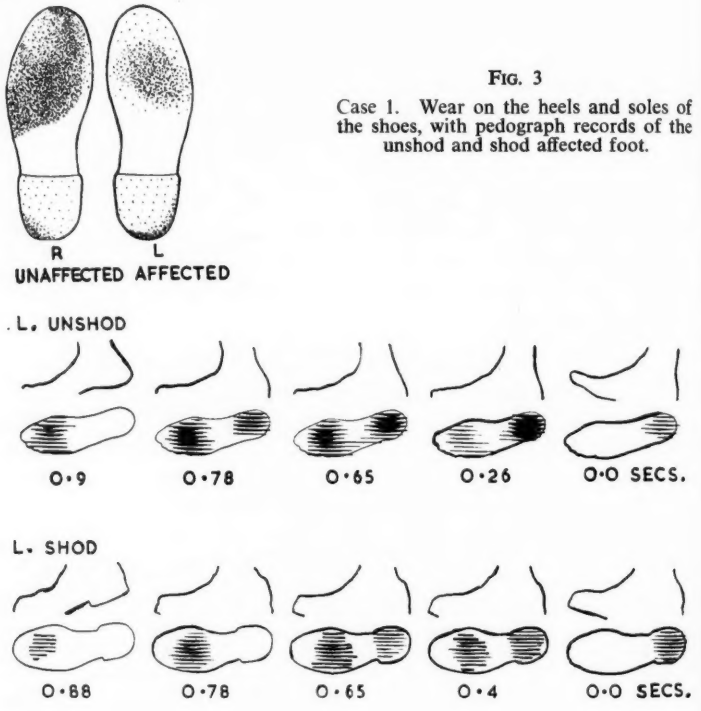

FIG. 3

Case 1. Wear on the heels and soles of the shoes, with pedograph records of the unshod and shod affected foot.

CASE 2: Right sciatic nerve injury with suture of the medial division.

Appliance: Full-length valgus insole. *Frequency of repair of shoes:* Heels—R : L : : 1 : 1; soles—R : L : : 1 : 4.

A marked limp was indicated on the right by relative shortening of the total duration of the stance phase. In the unshod pedographic records, early pressure was on the medial side of the heel and total duration of heel contact occupied 90% of the stance period. Metatarsal pressure was mainly on the medial side. There was no evidence of toeing-off. In the shod pedograph records,

pressure was borne by the whole heel but was maximal laterally; it was spread across the metatarsal heads and no toe action was detected. Wear on the heel was marked, but was postero-lateral and not medial in position, as might have been expected from the unshod pedograph record. In spite of the absence of pedograph evidence of pressure from the toes, there was a strip of localized wear in the middle segment of the anterior half of the sole. The frequency of repairs of the soles of the shoes correlated with the presence of a pronounced limp and consequent shortening of duration of the stance period. The distortion

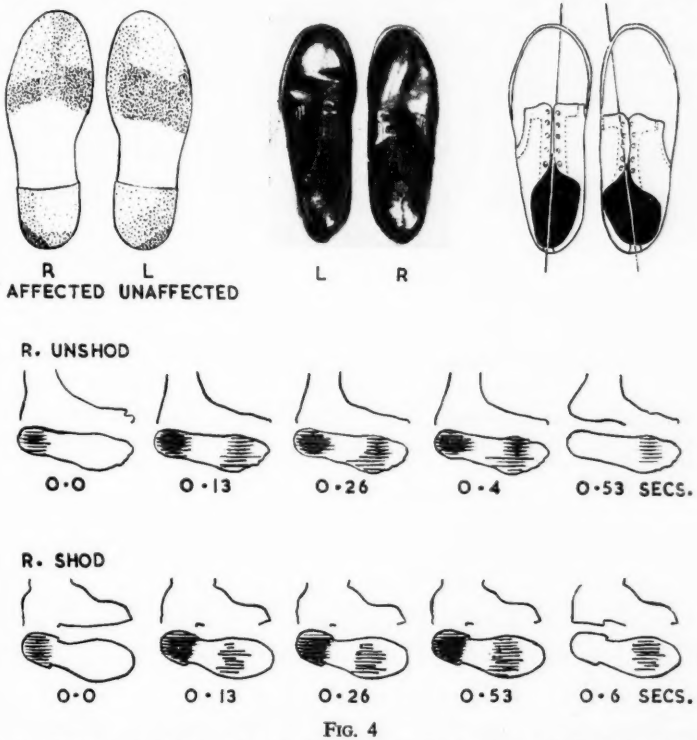

FIG. 4

Case 2. Wear on the heels and soles, distortion of the uppers, and displacement of the axis of the inlet of the shoes, with pedograph records of the unshod and shod affected foot.

of the upper—the axis of inlet being directed medially—and the relatively light wear on the lateral border of the sole (Fig. 4) agreed with clinical and pedographic findings. The absence of a toe crease on the right reflected the inactivity of the digits (Fig. 4).

COMMENT ON GROUP I

Relative overactivity of the dorsiflexors and evertors of the foot coupled with paralysis of the intrinsic muscles led to a plano-valgus deformity with hyper-

extension of the toes, which were extended at all joints. On clinical examination there might or might not be a pronounced limp, and the gait was of a plodding type. The affected foot was turned outwards in the swing period of walking and lifted abruptly at the end of the stance period. In standing there might be a conspicuous lateral rotation of the whole limb. Pedograph records showed prolonged heel contact and an abnormal shift of the maximal pressure from the lateral towards the medial border of the sole.

Wear on the heels conflicted with the pedograph records, since it was maximal on the postero-lateral aspect rather than the medial. This discrepancy is explained by the fact that the postero-lateral wear on the heel is due to frictional and shearing forces of the heel-strike, which are not revealed by the pedograph records. The out-turning of the foot during the swing period accounts for the location of this wear.

In the absence of pedographic evidence of toe pressure, the wear on the anterior half of the sole of the shoe in Case 2 suggests that it was either the result of scuffing during the swing period which cannot be recorded on the pedograph, or the result of pressure which was too light to register. It is suggested that repeated slight passive pressure from a stiff hallux was responsible for the wear on the anterior half of the sole, and that the shift of the wear from the extreme medial border was due to the effect of the insole.

Group II: Imbalance due to Relative Overactivity of Centre Plantar Flexors and Invertors of Foot

CASE 3: Right lateral popliteal nerve lesion.

Appliance: Double below-knee side irons, round spurs and centrally placed toe-raising spring. *Frequency of repairs:* Shoes repaired simultaneously, the right heel and left sole being most heavily worn.

Comparison of the unshod and shod pedograph records of the right foot was instructive and demonstrated the effect of the appliance in restoring the normal sequence of gait. Without the appliance the first phase was lost, the heel and sole making immediate simultaneous contact on the outer border of the foot. The toe-off was of short duration in the unshod and shod records of this foot. The reduced activity of the toes was indicated by the diminished toe crease (Fig. 5).

In the pedograph records of the left foot the sequence of phases and the distribution of pressures were within normal limits. However, the heel contact was prolonged and the final toeing-off was of short duration (Fig. 5). In agreement with these findings, the wear on the back of the heel was pronounced and there was relatively slight wear of the toe. The wear of the sole and upper was consistent with a plano-valgus deformity noted clinically.

CASE 4: Left sciatic nerve lesion with suture of the lateral popliteal division.

Appliance: Shoes worn with centrally placed toe-raising spring fixed to below-knee cuff, no irons. *Frequency of repairs:* Shoes repaired simultaneously, the right heel and sole being most heavily worn.

There was strict agreement between the pedographic findings and the wear of shoes (Fig. 6). With the appliance there was marked reduction in duration

of the first phase, but the total duration of heel contact was prolonged. Pressure was taken on the lateral side of the heel and foot and never rose to normal limits under the medial border of the foot. The final toeing-off was weak and

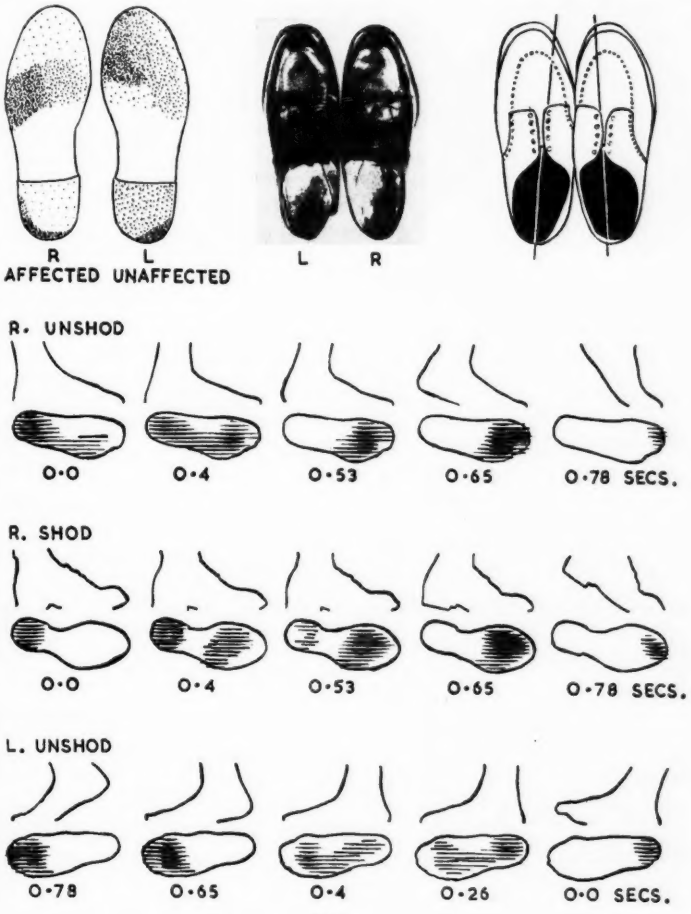

FIG. 5

Case 3. Wear on the heels and soles, distortion of the uppers, and displacement of the axis of the inlet of the shoes, with pedograph records of both feet.

of short duration, owing to weakness of the flexors and intrinsic muscles, associated with contractures of the extensors of the toes and secondary changes in the metatarso-phalangeal joints. The axis of the inlet of both shoes was directed medially, in association with the plano-valgus foot noted clinically.

CASE 5: Left sciatic nerve lesion.

Appliances: Double below-knee irons with square spur and concealed spring. Valgus insole. *Frequency of repairs:* Shoes repaired simultaneously, but the left is more heavily worn.

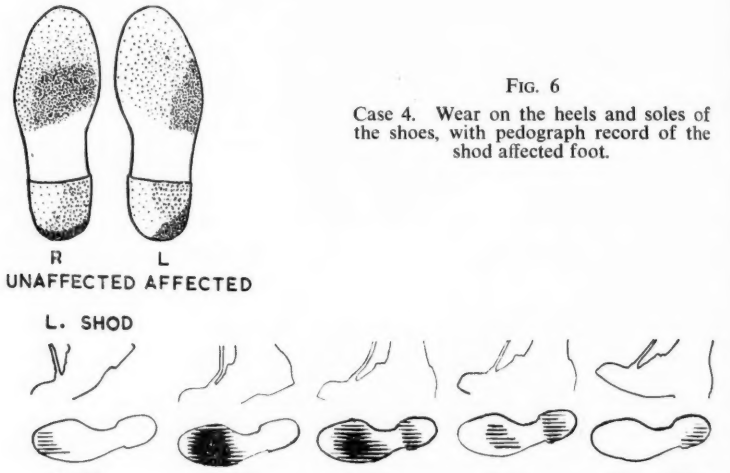

FIG. 6

Case 4. Wear on the heels and soles of the shoes, with pedograph record of the shod affected foot.

The pedograph showed reduction in pressure under the heel, but wear was excessive postero-laterally. This wear was probably attributable to the heel strike of the markedly out-turned foot. Both the pedograph records and the

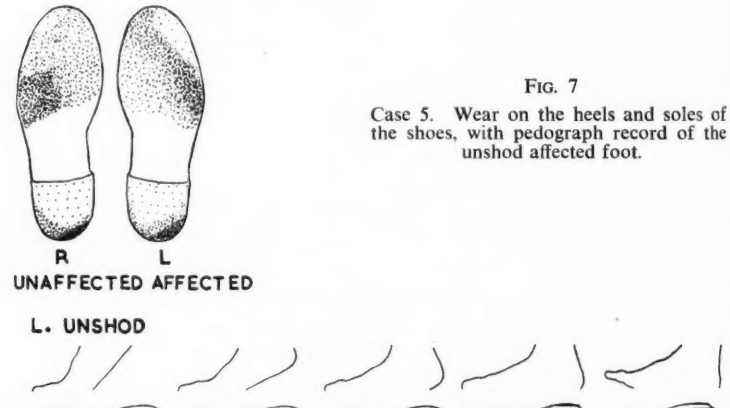

FIG. 7

Case 5. Wear on the heels and soles of the shoes, with pedograph record of the unshod affected foot.

shoes indicated relative excess of pressure under the outer metatarsal heads (Fig. 7), although there was sparing of the antero-lateral segment of the sole. Wear was marked antero-medially. These observations can be correlated with the pedographic evidence of premature contact of the hallux and inactivity of the outer toes. The out-turning of the foot might have been an additional factor contributing to the more conspicuous wear of the antero-medial segment. The wear of the upper reflected a pre-existing plano-valgus deformity upon which the effects of the muscle imbalance were superimposed, and the reduced toe creases on the left indicated diminished activity of the toes.

COMMENT ON GROUP II

The three patients in this group had a drop-foot with the expected equino-varus deformity, which was only partially corrected by the appliance in Cases 3 and 4. Lack of successful correction was shown by the shortened first phase of the step, the prolonged heel contact, and the excessive pressures on the lateral side of the foot. The more even distribution of pressure in Case 5 indicated the greater efficiency of his appliance. There was an apparent discrepancy between the wear of the sole and upper of the shoe on the affected side in each patient. The sole indicated an equino-varus deformity, whereas the axis of the inlet indicated a valgus deformity. It happened that the paralytic imbalance had been superimposed upon a pre-existing plano-valgus foot in each patient; the foot touched the ground in an equino-varus position and rolled into plano-valgus as it bore increasing weight. The reduced wear on the anterior half of the soles indicated the degree of ineffectiveness of toe pressure. Only in Case 5 could the hallux move effectively, and its effectiveness was demonstrated in both the pedographic record and the wear of the shoe. In each case the diminished activity of the toes was shown by the less conspicuous toe creases.

Group III: Imbalance due to Relative Overactivity of Calf Muscle Associated with Paralysis of Flexors of Toes and Intrinsic Muscles of Foot

CASE 6: Suture of right sciatic nerve.

Appliances: None. Toe-raising spring now discarded. *Frequency of repairs:* R:L::1:2.

The total duration of the stance period was only slightly reduced. The heel phase was unduly short, for pressure was taken almost immediately on the sole, particularly under the two outer metatarsal heads, and it then spread across to the medial side of the foot. The total duration of heel contact was abnormally prolonged and toe pressure was concentrated mainly beneath the first. The toeing-off phase was absent. On the unaffected side there was also a reduction in the first phase with prolongation of the total duration of contact of the heel. At no stage was there any pressure under the outer toes, and once more the toeing-off phase was completely absent (Fig. 8)

The distribution of wear of the heel and sole reflected these findings, but scuffing on the toe indicated the presence of a drop-foot during the swing phase of the step. There was reduction of the toe crease on the right. The frequency of repairs coupled with the fact that there was only slight reduction

in duration of the stance phase suggests that the total pressure on the affected side must have been reduced. This can be explained only by the patient's habitual use of a walking-stick.

CASE 7: Suture of right sciatic nerve.

Appliances: Toe-raising spring discarded. Floated-out heel, $\frac{1}{8}$-inch outside wedge to sole, metatarsal pad. *Frequency of repairs:* Shoes repaired simultaneously, but left more heavily worn.

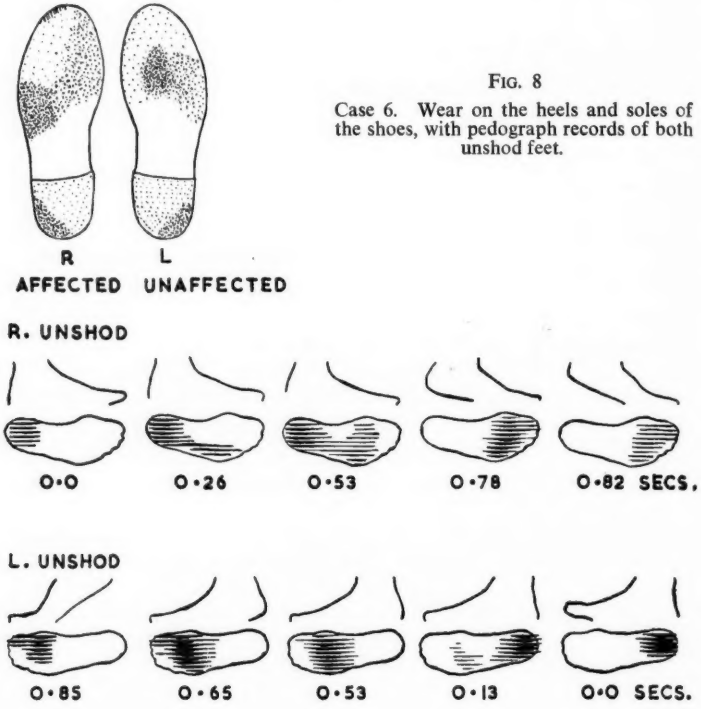

FIG. 8

Case 6. Wear on the heels and soles of the shoes, with pedograph records of both unshod feet.

The reduction in the duration of the total stance period was indicative of a pronounced limp. The first stage was absent owing to the premature contact made by the sole under the two outer metatarsal heads, which bore maximal pressure throughout. There was abnormal prolongation of the total period of heel pressure (i.e. phase 1 plus phase 2) from about 50% to 83% of the stance period. The last two phases were absent and indicated lack of toe function, the foot being lifted abruptly and vertically. The diminished toe crease and lack of wear on the anterior half of the sole were in conformity with this. The presence of an inversion deformity was indicated not only by the pedograph but also by the more marked wear of the sole of the shoe. The spread

of wear to the medial border of the shoe had presumably resulted from a floated-out heel and $\frac{1}{8}$-inch outside wedge of the sole. Heel contact was also prolonged on the unaffected side and the toeing-off phase was absent (Fig. 9).

COMMENT ON GROUP III

Both patients had preferred to discard the use of a toe-raising spring, as the drop-foot was partially compensated for by stiffness of the ankle and foot. Since both showed some degree of inversion deformity of the foot, it might

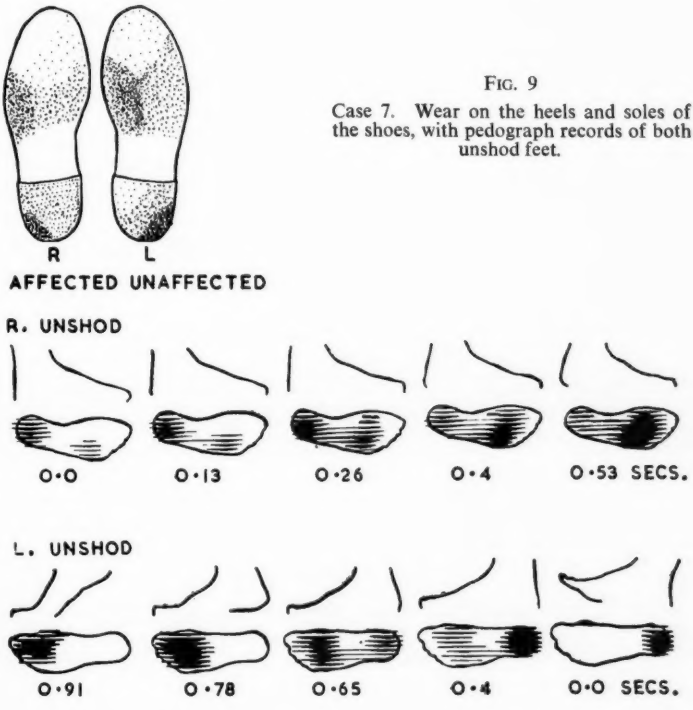

FIG. 9

Case 7. Wear on the heels and soles of the shoes, with pedograph records of both unshod feet.

be considered artificial to separate this group from Group II. However, in Group III the imbalance was predominantly due to overactivity of the calf muscle, and in addition the long flexor muscles of the toes and the intrinsic muscles of the foot were paralysed. The pedograph record demonstrated a gross prolongation of the heel phase, even in the unaffected limb, indicating a tendency to lean backwards during walking. The active calf muscles were unopposed and also the site of severe contractures, leading to a lack of both passive and active dorsiflexion at the ankle and to a prolongation of heel contact. The inversion deformities due to secondary changes in the joints were reflected in pedographs and shoe wear.

The apparent activity of the paralysed hallux on the right which was demonstrated by the pedograph record and by the wear of the sole of the shoe in Case 6 can be attributed to passive pressure from the rigid hallux. Although the degree of foot-drop did not differ significantly in these two patients, scuffing of the toe of the shoe was present in Case 6. This was almost certainly associated with the restricted range of flexion in the knee-joint.

Group IV: Imbalance due to Paralysis of Intrinsic Muscles of Foot

CASE 8: Right sciatic nerve lesion.

Appliances: Insole with metatarsal pad on right. *Frequency of repairs:* Sole and heel—L:R::2:1.

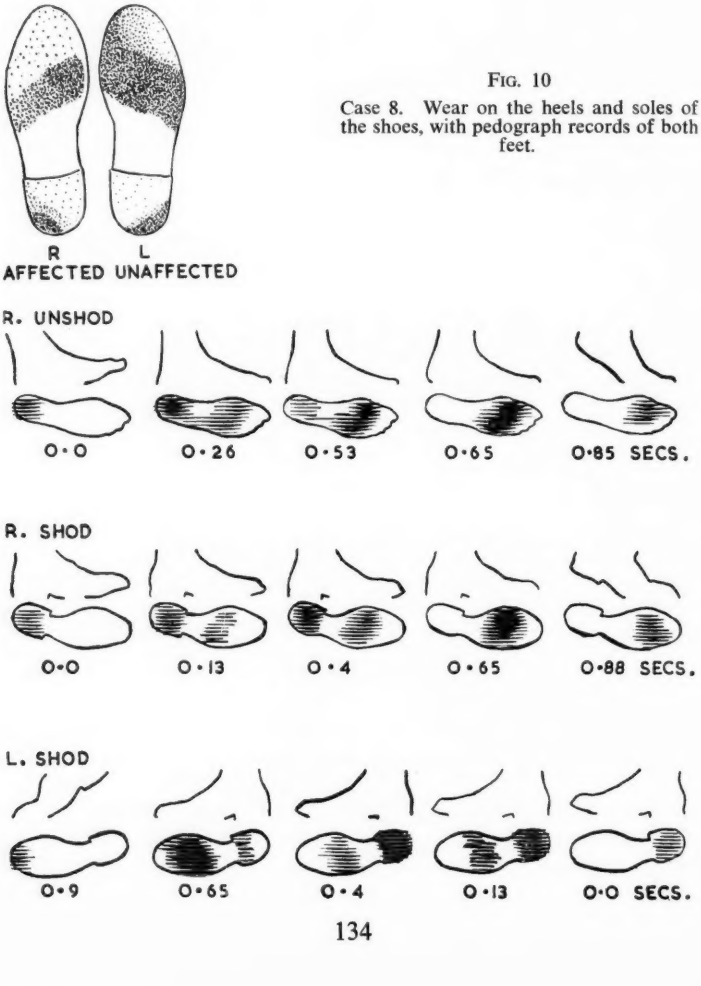

FIG. 10

Case 8. Wear on the heels and soles of the shoes, with pedograph records of both feet.

On the affected and unaffected sides the duration of heel pressure was prolonged beyond the normal 50% of the stance period to 65% and 62% respectively. In shod and unshod pedograph records the toeing-off was absent on the right. On the left side the hallux pressure occurred earlier than usual, and in the later stages pressure was high on the medial side of the unshod foot. In the shod foot, pressure was slightly reduced in the same region during the middle phase. The wear of heels and soles showed a close correspondence with the combined findings of the unshod and shod pedograph records.

On the affected side the axis of the inlet was directed slightly laterally, but there was no abnormal distortion of the left shoe. The accentuated toe crease on the right reflected activity in the markedly clawed toes, which, however, were unable to reach the ground and thus produce effective pressure in the final phase of the step.

CASE 9: Suture of right posterior tibial nerve just proximal to the ankle.

Appliances: Surgical shoes. Right heel floated out laterally, rocker on sole. Insole with metatarsal pad. *Frequency of repairs:* Shoes repaired simultaneously, but the left sole and right heel always show the heaviest wear.

The most striking feature of the unshod pedograph records was the excessive pressure beneath the postero-lateral part of the heel throughout the

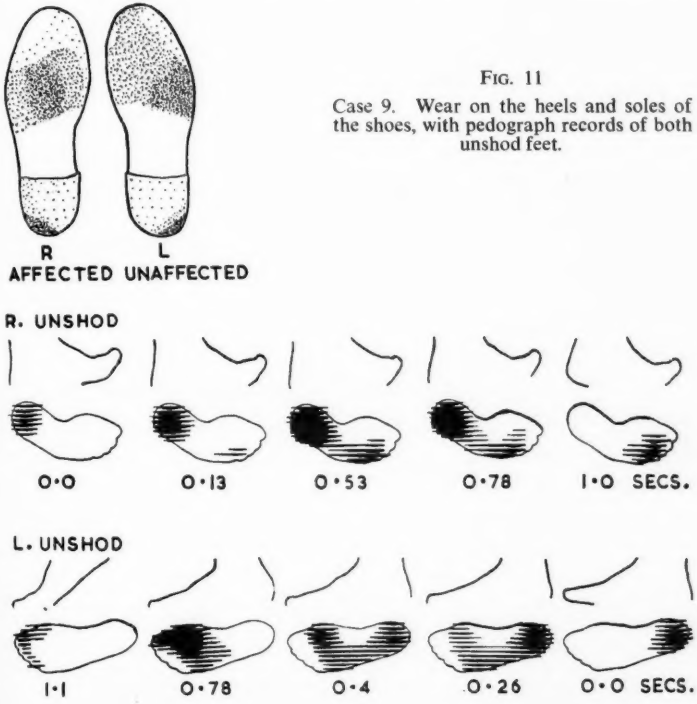

FIG. 11

Case 9. Wear on the heels and soles of the shoes, with pedograph records of both unshod feet.

first two phases. There was an increased duration of heel contact from the normal 50% to 90% of the total stance period. The distribution of pressure under the metatarsal heads was abnormal, being concentrated entirely beneath the 5th, 4th, and later the 3rd heads; no contact with the ground was made by the 1st metatarsal. There was complete absence of the toeing-off phase. On the unaffected side the pedograph was normal until the last two phases, when the pressure was borne mainly by the medial metatarsals and the hallux. On the affected side the heel of the shoe conforms with these observations, but it is clear that the rocker had modified, although it had not fully corrected,

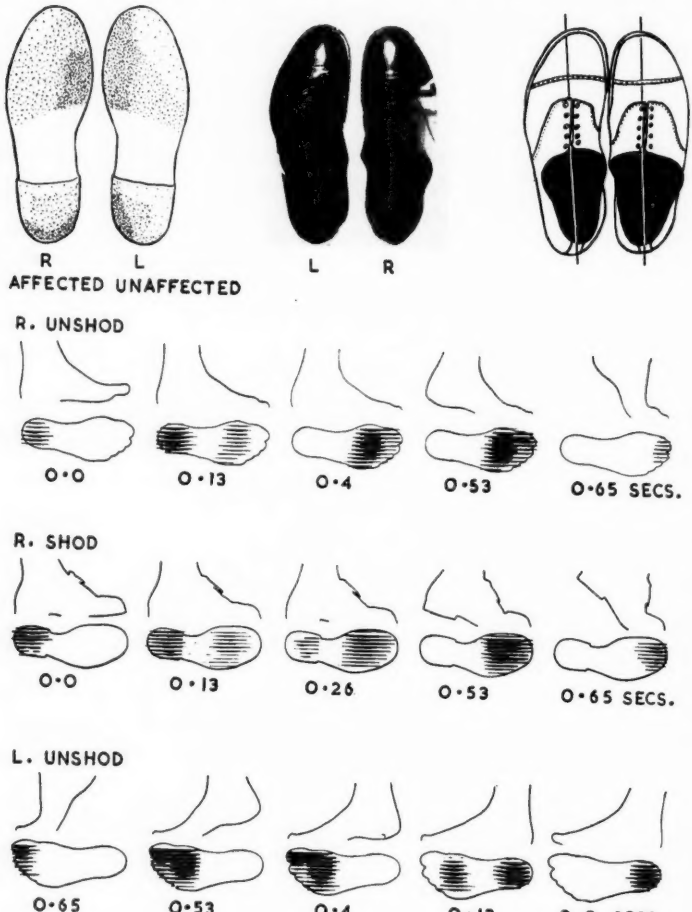

FIG. 12

Case 10. Wear on the heels and soles, distortion of the uppers, and displacement of the axis of the inlet of the shoes, with pedograph records of both feet.

the abnormal distribution of pressure under the metatarsal heads; it had the effect of producing slight wear on the anterior half. There was no distortion of the inlet of the shoe, although there was some overlap of the uppers on the lateral side of the heel, suggesting a stiff foot in varus position. The toe crease was markedly exaggerated. On the unaffected side there was no undue wear of the sole under the first metatarsal head, as might have been expected from the pedograph records.

CASE 10: Right posterior tibial nerve lesion, just proximal to the ankle, superimposed on bilateral pes cavus and metatarsus varus.

Appliances: Surgical shoes, inside wedge of sole and heel, valgus stiffener, and metatarsal pad. *Frequency of repairs:* Shoes repaired simultaneously.

The pedograph records and wear of the shoes were in close agreement. The records gave evidence of bilateral pes cavus, most marked on the left. Pressure was reduced under the lateral side of the feet and increased under the medial. On the injured side the toeing-off phase was reduced. The medial side of the heel of both shoes was unusually worn, but there was more widespread wear on the right, possibly due to the effect of the insole. On both shoes the medial segment of the posterior half of the sole was relatively more worn than the lateral (Fig. 12). Pressure under the left hallux was premature and prolonged. On the injured side, in addition to the tendency to take weight on the medial border, there was a fixed flexion deformity of the hallux.

There was a distortion of the inlet of the shoe on both sides, the axis being directed laterally. The accentuation of the right toe crease was more marked on the lateral half of the shoe (Fig. 12).

COMMENT ON GROUP IV

In this group of patients the activity of the toes was either absent or reduced during the final take-off phase. The presence of contractures of the extensors in Cases 8 and 9 not only reduced the effectiveness of the long flexors of the toes, but was also probably responsible for the increased duration of heel contact. The characteristic findings in this group were evidence of reduced or absent pressure on the anterior half of the sole, coupled with an increased depth of the toe crease on the uppers. The exaggerated crease was due to the underlying clawed toes; where movement of the toes was possible, the crease was still further accentuated. The presence of a bilateral congenital deformity in Case 10 accounts for the differences between this and the other two cases in the group.

Discussion

In addition to the examination of the motor and sensory systems in a patient with a locomotor disorder of the lower limb, an accurate determination is required of the mechanical effects of the abnormal gait upon the feet. The sequence and duration of each phase and the distribution of pressure in the stance period of gait have been measured quantitatively by several other workers, including Elftman (1934) and Schwartz and Heath (1947). Since these techniques are more suitable for research

purposes than for general clinical use, the clinician must rely on less elaborate and time-consuming procedures, such as the examination of shoes.

Over and above these economic and practical considerations, the study of shoe wear, in fact, supplies additional information. Events taking place during the swing period cannot be recorded by any pedograph. There is, for instance, no pedographic counterpart of the scuffing of the tip of the sole characteristic of the incompletely compensated foot-drop (e.g. Case 6). Similarly the initial contact of the heel with the ground (the heel-strike) which produces the characteristic frictional wear on the postero-lateral segment of the heel is not detectable in pedograph records. In addition, the evidence of wear on the anterior half of the sole in Case 2 indicates that the shoe provides a sensitive record of minor pressures which fall below the threshold of the pedograph. Changes in the pattern of wear of shoes may, in fact, be the only objective evidence of minor alterations in gait resulting from the use of corrective appliances.

The significance of wear of the heels and soles cannot be fully assessed without considering the state of the uppers. For example, absence of wear on the anterior half of the sole may be associated with a diminished toe crease (Case 1) or with an exaggerated one (Cases 8 and 9). Ineffective toe pressure does not necessarily indicate paralysis of the long or short flexors. These may be active although unable to overcome an opposing extensor contracture. Conversely, signs of wear on the anterior half of the sole do not necessarily betoken activity of the toes; for example, in Case 2 wear in this region was attributable to passive pressure from an inactive but stiff hallux; in this case, as might be expected, the toe crease was absent. Another example of the value of taking into consideration the wear of the uppers is provided by the patients in Group III. The wear of the heels and soles in this group was consistent with the paralytic equino-varus, while the distortion of the inlet suggested a plano-valgus deformity. Examination of the contralateral shoe revealed that the plano-valgus deformity was bilateral and had presumably preceded the nerve injury.

The study of shoe wear is a reliable indication of abnormal distribution of pressure provided the shoes are well-fitting. Inequality in the size of the feet due perhaps to wasting of the intrinsic muscles may allow the affected foot to shift within the shoe, which would thus not necessarily reflect the real nature of the disorder.

It is obvious that the pattern of shoe wear is derived from the superimposition of the pressure effects of standing, walking, and running, and thus it is not possible to determine whether abnormal wear results from undue pressure or from an undue duration of an otherwise normal pressure. For instance, heavy wear on the postero-lateral part of the heel was due to increased heel pressure in Case 1, and to a prolonged heel contact in Case 3. The impossibility of determining from a study of shoe wear alone

the temporal relationships between the phases of the stance period is an inherent limitation of the method; pedograph records, on the other hand, give precise information on this point.

Summary and Conclusion

The empirical assumption that the study of shoes is a reliable means of estimating the effects of locomotor disorder of the gait has been subjected to critical analysis. It has been found that the results derived from study of shoe wear and from the analysis of pedograph records are in striking agreement. It is concluded that study of the wear of shoes is a means of gaining reliable information provided that all the available evidence from heels, soles, and uppers of both sides is taken into consideration and used in association with the clinical findings.

APPENDIX

Clinical Details of Cases

The relevant points from the history and clinical examination of each patient are summarized briefly. The Medical Research Council scale has been used to denote the degree of motor and sensory recovery in the affected nerves (Zachary, 1954).

CASE 1: Left sciatic nerve lesion.

Lateral Popliteal Division.—Slight weakness of all muscles. (M.R.C. scale of recovery, M4 S4.)

Medial Popliteal Division.—The calf muscle contracted against weak resistance, the remaining proximal muscles acted against gravity. There was moderately severe atrophy of the intrinsic muscles. (M.R.C. scale of recovery, $M1_{(3+)}$ S3.)

On the left there was slight restriction of plantar flexion and dorsiflexion of the ankle and a mild contracture in the long extensors of all the toes. There was some thickening of skin under the medial border of the heel.

Stance.—Bilateral plano-valgus, more pronounced on the affected left side, where all toes were hyperextended; the hallux was also abducted.

Gait.—Slight limp. The left foot was turned outwards.

CASE 2: Right sciatic nerve injury with suture of the medial division.

Lateral Popliteal Division.—Some weakness of all muscles. (M.R.C. scale of recovery, $M1_{(4+)}$ S3.)

Medial Popliteal Division.—Complete motor paralysis apart from contraction of the calf muscle against gravity. Gross atrophy of the intrinsic muscles of the foot. (M.R.C. scale of recovery, $M1_{(1)}$ S1.)

There was stiffness of the metatarso-phalangeal joints and a contracture of the extensor digitorum longus. Skin was thickened under the head of the first metatarsal and on the medial border of the heel.

Stance.—Unshod: Right leg externally rotated; bilateral plano-valgus, most marked on the affected side. All toes of the right foot, excluding the hallux, were hyperextended and raised from the ground. *Shod:* Plano-valgus marked on right.

Gait.—Pronounced limp, right foot turned outwards.

CASE 3: Right lateral popliteal nerve lesion.

Lateral Popliteal Nerve.—Apart from doubtful contraction of the peronei, there was complete motor paralysis. (M.R.C. scale of recovery M0 S1.)

Medial Popliteal Nerve.—Slight generalized weakness of muscles, no detectable atrophy of intrinsics. (M.R.C. scale of recovery, M4 S4.)

At rest the affected foot was in equino-varus with pronation of the forefoot. There was a mild degree of fixed inversion of the heel, with limitation of eversion of the forefoot and stiffness of the toes. There was a moderate contracture in the calf muscle and extensors of the toes. Skin was thickened under the hallux and the outer border of the foot.

Stance.—Unshod: Mild valgus deformity on the right, marked plano-valgus on the left. *Shod, with appliance:* Partial correction of valgus deformity on right.

Gait with Appliance.—Slight slap on the right. Both feet turned outwards, but less markedly on affected side.

CASE 4: Left sciatic nerve lesion with suture of the lateral popliteal division.

Lateral Popliteal Division.—Complete paralysis. (M.R.C. scale of recovery, M0 S0.)

Medial Popliteal Division.—All muscles contracted against resistance. There was generalized weakness, particularly in the intrinsic muscles of the foot, which were moderately severely atrophied. (M.R.C. scale of recovery, M4 S2.)

At rest there was a marked equino-varus. Passive dorsiflexion of the ankle, eversion of the foot, and flexion of the metatarso-phalangeal joints were restricted. There was a moderate contracture of the calf muscle and a mild one in the extensors of the toes. Callosities were present under the 5th metatarsal head and on the dorsum of the 3rd and 5th toes.

Stance Unshod.—Bilateral plano-valgus with splaying of the forefoot.

Gait.—Unshod: High stepping with an inward swing of the dropped left foot. *Shod, with appliance:* Fairly good but with an audible slap.

CASE 5: Left sciatic nerve lesion.

Lateral Popliteal Division.—Tibialis anterior and extensor hallucis longus active with gravity eliminated; peronei and extensor longus digitorum were able to overcome gravity. (M.R.C. scale of recovery, $M1_{(2+)}$ S1.)

Medial Popliteal Division.—All muscles were weaker than normal; only the calf muscle contracted against a strong resistance. The intrinsic muscles were slightly atrophied. (M.R.C. scale of recovery, M4 – S2.)

At rest the left foot fell into marked equino-varus with pronation of the forefoot and mild clawing of the toes. There was no passive flexion of the outer four metatarso-phalangeal joints and it was restricted in the 1st. The 3rd, 4th, and 5th toes were stiff. There was a mild contracture in the calf muscle. Skin was thickened under the metatarsal heads of both feet, particularly under the medial border of the left hallux and under the head of the 3rd left metatarsal. Callosities were present under the 2nd and 5th toes.

Stance.—Bilateral plano-valgus deformity, improved but not corrected by shoes.

Gait, with Appliance.—Walks with limp, the left foot turned outwards.

CASE 6: Suture of right sciatic nerve.

Lateral Popliteal Division.—Complete paralysis. (M.R.C. scale of recovery, M0 S0.)

Medial Popliteal Division.—Calf muscle and tibialis posterior acted against

gravity. The intrinsics were severely atrophied. (M.R.C. scale of recovery, $M1_{(1+)}$ S1.)

At rest there was slight pronation of the right forefoot. There was marked restriction of passive movements of the ankle and the remaining joints of the foot. The hallux was flexed at the interphalangeal joint. Flexion of the knee was limited from 5° to 45°; extension of the hip was also limited. There was a moderately severe contracture in the calf muscle and in the extensors of the toes. The skin was markedly thickened under the 5th metatarsal head and the medial border of the hallux, and slightly thickened under the lateral border of the heel.

Stance, Shod and Unshod.—Slight valgus deformity of the right foot.

Gait.—Tended to intoe, marked limp, and mild degree of drop-foot on the right.

CASE 7: Suture of right sciatic nerve.

Lateral Popliteal Division.—Complete paralysis. (M.R.C. scale of recovery, M0 S0.)

Medial Popliteal Division.—The calf muscle was capable of contracting against resistance, otherwise paralysis was complete. Intrinsic muscles were grossly wasted. (M.R.C. scale of recovery, $M1_{(1)}$ S0.)

Passive movements of the ankle and foot were markedly restricted, with fixed inversion of the subtaloid and mid-tarsal joints. The toes were in a neutral position. There was a severe contracture of the calf muscle and a moderate one in the extensors of the toes. There was a large callosity under the 5th metatarsal head.

Stance.—Unshod: Inversion of the heel with pronation of forefoot. *Shod:* Position improved.

CASE 8: Right sciatic nerve lesion.

Lateral Popliteal Division.—Slight generalized weakness, all muscles contracted against resistance. (M.R.C. scale of recovery, M4 S2.)

Medial Popliteal Division.—The calf muscle and tibialis posterior were slightly weaker than normal, the long flexors of the toes contracted against weak resistance, and the intrinsic muscles of the foot were paralysed and grossly atrophied. (M.R.C. scale of recovery, $M1_{(4)}$ S2.)

There was slight limitation of dorsiflexion of the ankle-joint and of movements of the subtaloid and mid-tarsal joints. The toes were stiff. Contractures of the extensors of the toes were severe, particularly in the extensor digitorum longus. There were callosities under the 1st, 4th, and 5th metatarsal heads.

Stance.—Unshod: There was slight inversion of the right heel and varus of the forefoot, weight appeared to be taken mainly under the medial and middle metatarsal heads. There was a valgus deformity of the hallux and all toes were clawed, especially the 5th. Left foot, mild plano-valgus. *Shod:* No obvious abnormality.

Gait.—Appeared normal.

CASE 9: Suture of right posterior tibial nerve just proximal to the ankle.

Lateral Popliteal Nerve.—Unaffected.

Medial Popliteal Nerve.—The calf muscle and tibialis posterior were weaker than normal, although their nerve supply was unaffected by the injury. There was a feeble contraction in the long flexors of the toes, probably due to local damage to tendons. There was a doubtful contraction in the intrinsic muscles of the foot, which were not markedly atrophied. (M.R.C. scale of recovery (posterior tibial nerve), M?1 S1.)

There was slight restriction of movements of the ankle, heel, and forefoot. The first metatarso-phalangeal joint was ankylosed in hyperextension, flexion was grossly limited in the remaining metatarso-phalangeal joints. There was a mild contracture of the calf muscle and a severe one in the extensors of the toes. There was a callosity under the 5th metatarsal head, and the skin was thick and scarred under the heads of the 2nd, 3rd, and 4th metatarsals.

Stance, Unshod.—Pes cavus with hyperextension of the hallux and excessive clawing of the remaining toes, which did not touch the ground. Weight taken on the outer border of the heel and foot.

Gait.—Both feet turned outwards, right more than left; no heel–toe action detected in the unshod right foot.

CASE 10: Right posterior tibial nerve lesion just proximal to the ankle superimposed on bilateral congenital pes cavus and metatarsus varus.

Lateral Popliteal Nerve.—Unaffected.

Medial Popliteal.—Long muscles unaffected, apart from tibialis posterior, which was slightly weak, probably due to direct damage to the tendon. The intrinsic muscles were virtually paralysed but only moderately atrophied. (M.R.C. scale of recovery (posterior tibial nerve), M?1 S1.)

The foot was fully mobile apart from 30° fixed flexion of the interphalangeal joint of the hallux and limited extension of the interphalangeal joints of the four outer toes, which were clawed. On both sides there was a mild contracture of the calf muscle. The plantar fascia was contracted on the right.

Stance.—Unshod: Bilateral pes cavus and metatarsus varus with valgus heels. On the right the four outer toes were clawed. *Shod:* Stance improved.

Gait.—Marked in-toeing.

Acknowledgments

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OSTEOARTHRITIS

DISCUSSION HELD AT THE ANNUAL MEETING OF THE BRITISH ASSOCIATION OF PHYSICAL MEDICINE ON APRIL 27, 1956

I—R. M. MASON

I CANNOT think of a more important subject than osteoarthritis for our Association to discuss. We spend more time seeing, and our physiotherapists spend more time treating, osteoarthritis than any other disease group.

The time spent on a random 556 consecutive cases under treatment in our department at the London Hospital recently is analysed in Diagram 1.

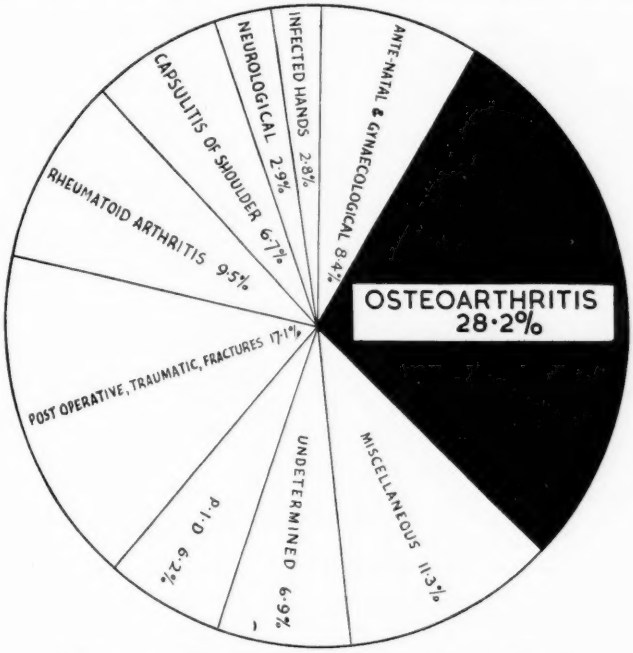

DIAGRAM 1.—Proportions of total treatment time in 556 cases.

It will be seen that, of the whole "cake" of physiotherapy, the slice devoted to osteoarthritis is by far the largest, amounting to no less than 28·2% of the total. The next largest slice, consisting of the group of post-operative, traumatic, and fracture cases, is more than 10% smaller; all the others are fairly evenly divided, and neurological conditions, such as hemiplegia and disseminated sclerosis, and the infected hand take rather smaller slices of

the time available. A disease which takes up such a large proportion of our physiotherapists' time certainly deserves all the discussion and thought we can give to it.

How does this come about? At the London Hospital we have an open, centralized department—that is to say, we see cases referred both direct from outside the hospital and also by our colleagues, either for opinion or diagnosis or, with an established diagnosis, for treatment. All patients

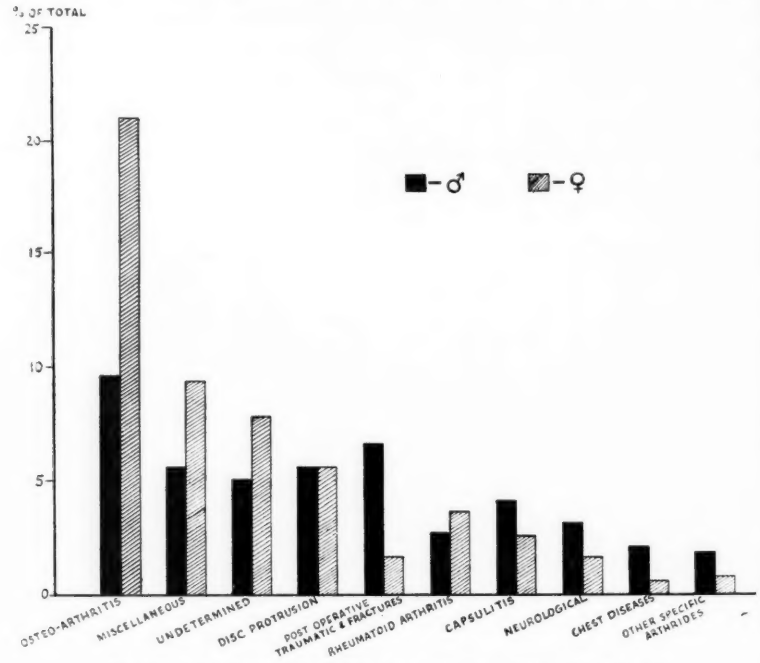

DIAGRAM 2.—Analysis of 471 new cases by diagnosis and sex.

requiring physiotherapy, other than exercises alone, at present must pass through our hands first, and we thus see nearly all cases before they go for treatment. It might be worth while, therefore, to analyse the disease categories of the new patients seen in the department.

Incidence

Diagram 2 is calculated from a sample of 471 new cases. These were consecutive cases seen in two months of the year—one a winter month, January, and one a summer month, June. These two months were chosen for no special reason other, perhaps, than that it ensures that weather conditions have no undue effect on the sample.

It will be seen that almost one-third of the new patients have osteoarthritis—that is to say, they have presented because of symptoms due to osteoarthritis. Many more than that, of course, have symptomless osteoarthritis but present with some other lesion. As Lawrence (1956) pointed out recently, 83% of the males and 87% of the females in the 55–64 age group in the general population have radiological evidence of osteoarthritis; but the patients in this sample are actually those whose symptoms have become sufficiently severe to justify to themselves, to their doctors, and to us a course of physical treatment. The preponderance of osteoarthritis over other diseases is quite striking, women being right out ahead; but it will be seen that men with osteoarthritis form the second largest group. There is this remarkable sex difference: in no other group do women exceed men by anything like the same amount. They are in the majority in the miscellaneous group, in the undiagnosed group, and, of course, in the rheumatoid arthritis group. But in all other categories males equal females—for instance, disk protrusion—or exceed them; thus in the traumatic category there are three times as many men as women. This

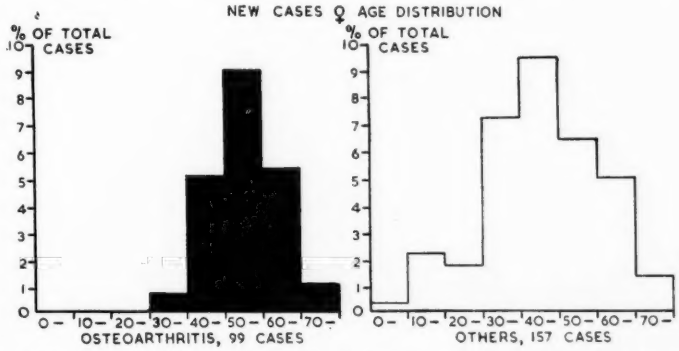

DIAGRAM 3.—Age distribution of new (female) cases, as percentages of total cases, in each decade.

preponderance of women, forming a large proportion of the total of new cases, is perhaps better illustrated by an analysis by decades of age of the 99 cases of women with osteoarthritis, compared with the rest of the sample of women, which comprised 157 patients.

Preponderance in Older Age Groups

From Diagram 3 it will be seen that of all female patients in the 6th and 7th decades—that is, aged 50 to 69—those with osteoarthritis actually form more than half the total. In the 6th decade this substantially exceeds all other disease groups added together, and the same applies to a lesser extent to the 7th decade. This is to say, if a woman aged between 50 and 69

walks into our consulting-room in the department, there is a more than even chance that she will be complaining of symptoms due to osteo-arthritis.

Sites Affected

Women presented most commonly with symptoms relating to osteo-arthritis of the cervical spine and of the knees. In the men the cervical spine was three times as common as any other joint as a cause of symptoms, the hips, knees, and lumbar spine being equally frequent thereafter. In proportion to the respective total numbers of each sex, however, the men presented with osteoarthritis of the hips twice as commonly as women, and the women nearly twice as frequently as the men with osteoarthritis of the knees. Thus in both sexes the cervical spine is the most common "presenting" joint, but osteoarthritis of the hips is more common in men, and osteoarthritis of the knees in women.

Time Spent on Treatment

To return to the treatment of these patients. Two further points seem to be worth studying: (1) How does the time spent on the physiotherapy of patients with osteoarthritis compare with that spent on the other conditions treated? (2) Is any evidence as to the chronicity of osteoarthritis obtainable from this type of study? With regard to the first question, I set out to find whether a patient with osteoarthritis takes up more, or less, of the physiotherapists' time than the patient with some other condition. One session of treatment, which in our department lasts half an hour, can be taken as the unit. When the patient has more than one kind of therapy—for example, heat and exercises—this counts as two sessions, of half an hour each. In this way it is possible to calculate the average treatment session for each group of patients.

TABLE I

AVERAGE TREATMENT SESSION FOR DIFFERENT DIAGNOSTIC GROUPS UNDERGOING PHYSIOTHERAPY

(One treatment session equivalent to half an hour treatment time)

Diagnosis	Males	Females
Prolapsed intervertebral disk:		
Cervical spine	2·7	2·0
Lumbar spine	1·8	1·7
Capsulitis	2·5	1·9
Osteoarthritis	1·8	1·9
Rheumatoid arthritis	1·8	1·8
Fractures, traumatic and post-operative	1·6	1·4
Tennis elbow	1·5	1·0
Chest diseases	1·3	1·1
Neurological conditions	1·2	1·1
Miscellaneous	1·5	1·4
Undetermined	1·6	1·5

Table I shows the result of such a calculation. In time spent osteoarthritis is third from the top for both sexes. It is exceeded only by disk protrusion of the cervical spine and capsulitis of the shoulder, which are both more time-consuming. More time is spent treating patients with osteoarthritis than those with fractures or traumatic and post-operative conditions. As much time is taken up with treating osteoarthritis in the individual patient as rheumatoid arthritis. The total treatment time given to each group, which is, of course, calculated by taking into account not only the average treatment session but the actual number of cases under treatment, has already been dealt with.

Proportion of Patients in Treatment Group

Is there any evidence that patients with osteoarthritis form a larger proportion of patients under treatment than are seen as new cases? This would be to some extent a measure of the length of time they are maintained on treatment. Clearly, if the patients in one group are continually having repeat courses of treatment, then they would tend to accumulate in the treatment group, and would thus form a higher proportion of the total than the fresh cases. A useful measure of this would be the ratio of the proportions of cases in the treatment group to the proportions in the out-patients group.

Such a calculation (Table II) shows no evidence that the osteoarthritic patients accumulate. There is a smaller proportion of females with osteo-

TABLE II

RATIO OF PROPORTION OF PATIENTS IN THE TREATMENT GROUP TO THE PROPORTION IN THE OUT-PATIENT GROUP BY DIAGNOSTIC CATEGORIES

Diagnosis	Males	Females
Osteoarthritis	1·0	0·7
Prolapsed intervertebral disk ...	0·6	0·4
Rheumatoid arthritis	1·2	1·5
Post-operative	1·6	4·0
Capsulitis	0·7	1·0
Neurological conditions	0·9	0·8
Miscellaneous	0·6	0·8
Undetermined	0·8	0·4

arthritis in the treatment group than among the new patients, and an exactly similar proportion of males. It will be seen that in the treatment group rheumatoid arthritis appears in a higher proportion in both sexes, which serves to illustrate the relative chronicity of rheumatoid arthritis. The high ratio of post-operative cases is, of course, a result of the number of patients referred simply for exercises, and therefore not appearing in the "new case" group at all.

These figures are very interesting, for they do not support the general concept of osteoarthritis as a chronic, progressive disorder. And, indeed, none of these patterns do more than support its frequency. As was shown above, this high frequency of the disease occurs in the 6th and 7th decades, but this is not followed by a high proportion in the 8th decade. I appreciate that there are relatively few survivors in the 8th decade, but in fact the proportion that is seen in out-patient departments follows, but does not exceed, the proportion of the age group in the general population. Yet the Leigh survey (Kellgren *et al.*, 1953) showed: (1) that the incidence of osteoarthritis in the population rises steadily with age, and (2) that 40 to 50% of those with clinical osteoarthritis had not consulted their family doctor.

However, if these patients had continued to deteriorate, then they would turn up as out-patients in the later decades. But they obviously do not. It might be suggested, of course, that they do not come because they have become so crippled; but this does not bear examination. How many domiciliary visits do we have to make to osteoarthritics too old and crippled to come to hospital? Even in our own area, where we provide a domiciliary physiotherapy service, the answer is, virtually none. Are they, therefore, in-patients in the chronic hospitals or chronic wards? Anyone acquainted with the problem of the chronic sick will know that osteoarthritis as a primary condition is very rare among them compared with hemiplegia, disseminated sclerosis, or rheumatoid arthritis. Indeed, a recent survey in Sheffield amongst the aged (Hobson and Pemberton, 1955) showed that, whereas 70% of the males and 80% of the females studied had osteoarthritis, only 8 of 275 women had some limitation of activity because of osteoarthritis, and only a further 4 were actually confined to the house—these last with osteoarthritis of the hip. And of the men, only 3 out of 186 had some limitation of outside activity due to osteoarthritis, and none was confined to the house, let alone bed-ridden.

Points to Discuss

I would like to introduce this discussion by putting forward the following points. Osteoarthritis represents by far the largest group of patients we see and the largest group of patients we treat. I can find no evidence to suggest that osteoarthritis is necessarily a chronic, progressive disease. I would suggest, therefore, that we need to review the natural history of osteoarthritis, perhaps with reference particularly to the influence of the joint affected on the prognosis, and possibly even more to whether the type of osteoarthritis is a significant factor. That is to say, does monarticular osteoarthritis due to some local factor have a different prognosis from that of generalized osteoarthritis? Such information will, of course, be obtained only from a prospective investigation, which would

give a very good opportunity for us to reassess the therapeutic value of the various forms of treatment we give, in the light of the natural history of the disease.

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II—C. E. QUIN

As my contribution to the discussion I should like to present the results obtained at the Arthur Stanley Institute in the treatment of osteoarthritis with hydrocortisone by intra-articular injection.

Of 41 patients who were given intra-articular injection of hydrocortisone for osteoarthritis of the knees, 11 derived no benefit and 30 had some relief of symptoms. The relief was slight in 5 cases, some relief of pain at rest being obtained; marked in 16 cases (complete relief of pain at rest and hardly any pain on walking); and moderate in the remaining 9 cases. The duration of benefit varied from two weeks to over three months.

Some relief of symptoms resulted in 9 out of 13 patients treated for osteoarthritis of the carpo-metacarpal joints of the thumbs, and this lasted for two to eight weeks. In osteoarthritis of the proximal and terminal interphalangeal joints of the hands the results were very satisfactory and usually lasted for several months.

In an investigation into the injection treatment of osteoarthritis of the hips, which is to be published in detail later, Dr. Leveaux and I have compared the results with hydrocortisone and those with procaine. Each group contained 15 patients. In the first group hydrocortisone and procaine together were given at the first injection, and, when the resulting relief had worn off, procaine alone was given for the second injection. In the second group procaine was given for the first injection and hydrocortisone for the second. Patients were asked, one week after the injection, whether their pain was more, less, or unchanged. When the results of the first injections—namely, hydrocortisone in Group 1 and procaine in Group 2—were compared, very little difference could be detected. When the results of the second injections—procaine in Group 1 and hydrocortisone in Group 2—were compared it was obvious that hydrocortisone was more effective, 10 patients given procaine having had more pain and 11 patients receiving hydrocortisone less pain.

In a further trial it was shown that results were not improved if patients did non-weight-bearing exercises immediately after an injection of procaine and hydrocortisone.

III—H. OSMOND-CLARKE

[Mr. Osmond-Clarke discussed various operative procedures in osteo-arthritis of the hip-joint. Vitallium-cup arthroplasty, osteotomy, and arthrodesis were sound surgical measures in carefully selected cases, but the Judet operation was no longer acceptable, particularly in view of the high incidence of fracture through the neck of the prosthesis.

Mr. Osmond-Clarke stressed the importance of planned rehabilitation following surgery of the hip-joint, and paid tribute to the help which he and his colleagues received from specialists in physical medicine.]

IV—W. A. FELL

In being the fourth speaker in a discussion of this type there are certain difficulties, in that many of the relevant authorities have already been quoted and many of the pros and cons of various aspects of treatment dealt with. I myself have no original work on degenerative arthrosis of the spine to put forward, but merely some views of my own.

Incidence

Various studies have been made showing the incidence of this condition at different levels of the spine, presumably in order to try to deduce what factors may be at work in causing the degeneration. The latest study, that done in 1953 by Boyle (1954), is a very comprehensive one and has not been superseded since by any other. There are, however, certain points in connexion with this and other studies which I should like to mention.

It seems to me that too much emphasis has been laid on the survey by Shore (1935). I remember Shore when he was doing this work and frequently used to visit his office to gossip with him. Now, in his paper he does not indicate the source of his material. In other papers he has given indications that his work was done on a series of vertebral columns found in the Witwatersrand University at Johannesburg, and on a series of vertebral columns located in the Anatomy Department at Cambridge. The former presumably consisted of Bantu skeletons. The latter, so far as I can remember, and so far as I can check with other members of the Anatomical Department, were a series of Egyptian spines of unknown age, which have since been dispersed elsewhere. I cannot help feeling that this basis for such a survey is not adequate. Presumably a study of incidence should, if possible, give indications of the cause of degeneration, but only when other relevant factors, such as age, occupation, and weight, are also known.

A new survey would be a very difficult undertaking. As Boyle has pointed out, this could be carried out either on post-mortem material, a very difficult proceeding, or radiologically, again not entirely a satisfactory

method, but probably the best at our disposal. Such a survey can be of use only if other relevant factors are considered at the same time. This will mean that each case will have to be charted, as it were, as regards not only its spine, but its occupation, age, life history, weight, and general activity. But is this practicable? For example, what effect has the incidence of vertebral osteochondritis on the production of osteophytosis anywhere in the spine? As would seem from Butler's (1955) survey in his presidential address to the Section of Orthopaedics of the Royal Society of Medicine last year, the probability of such a condition causing the degenerative changes in later life is a very large one. Can a start be made in eliminating the cases due to osteochondritis—perhaps on a statistical basis—and withdrawing a small corner of the blanket which covers the darkness of our ignorance? I shall refer to this again at a later stage.

Treatment

I find that these cases as a rule present in one of two ways: (1) as an acute flare-up, due to a sudden wrench or a further minor prolapse of an already degenerate disk, giving a clinical picture of the type to which such labels as acute lumbago and fibrositis are attached; or (2) as a dull aching backache with a clinical picture of stiffness associated with occasional acute flare-ups of the type already described.

Now, the short-term treatment of the acute flare-up I need not deal with in any detail; heat, with exercises within the range of pain, increasing as the pain diminishes, seems to be the type of treatment most commonly given. What are we to do as regards the long-term treatment? Are we to mobilize the stiff back, or are we to allow it to stay stiff and, being stiff, relatively painless? I do not think that any one answer can be given which fits a large number of patients, but that each patient must be considered separately, and I suggest that the following factors are amongst those which should be considered in deciding on the handling of a particular case: age, occupation, the degree of damage as seen by X rays, the stiffness of the spine, and the type of person the patient is.

To digress for a moment. It is sometimes a great shock to see a badly damaged spine in an elderly farm-worker, whose X-ray picture causes one to gasp at the degree of disk degeneration and destruction that has taken place. And yet, more often than not, that finding is accidental during investigation for something quite different. This badly damaged spine undoubtedly has given him a lot of pain and trouble in the past, yet he does his work satisfactorily with it, and I venture to suggest that he himself has learnt from bitter experience that if he works with a stiff back and avoids wrenches and excessive strain he is likely to stay free of trouble. Living in a Fen village as I do, one can see the elderly farm-worker doing this—moving as a lump with a stiffness of his whole trunk.

But inasmuch as arduous work is probably responsible for this degree of damage, and has, in a sense, paradoxically contributed to his "cure" or freedom from symptoms, so the same factors are not at work in the housewife, ageing, but engaged in relatively light work, whose spine is a nuisance to her because she cannot bend around as she used to do. I feel that in such cases where the patient is older, the occupation arduous, and there is a fair degree of damage which is not likely to progress, relative immobilization by means of a belt is probably one of the best treatments available. Where the patient is younger and lighter, in not too vigorous an occupation, and is co-operative and will understand what you are aiming at, then the proper treatment is to attempt to mobilize the spine, in order that the maximum amount of function can be retained. Later in life, should the enthusiasm for exercising begin to flag, the patient could, aided by a belt, be allowed to progress into the first group I have described, and relative immobilization could set in with retirement, though the weight of geriatric opinion may be against this. It depends on the individual patient.

Prevention

Lastly I should like to mention the subject of prevention. No one, I think, will dispute that we are going to see more and more of disk degeneration at all levels, simply because the average age of the population is getting higher and more and more elderly patients will be seeking the aid of physiotherapy for this condition. Can anything be done to prevent this? Obviously nothing can be done if, as some think, there is a congenital tendency to degeneration of disks in certain patients. But there are ways in which we can help.

Obesity.—Surely one of the best weapons at our disposal is the reducing diet for those in middle age. By its means not only can we reduce the over-all load on the vertebral column, but we can prevent the hyperlordosis in the lumbar region and the upper thoracic kyphosis, and thereby relieve the chronic overstrain on the vertebral bodies as well as that on the badly aligned apophysial joints which in time will show a true osteoarthritis.

Posture.—Can we not attempt in younger people to inculcate a proper posture? That leads in turn to the question, "What is proper posture?" We have a rough idea, and work such as that described some time ago by Barlow will perhaps fill up the gaps in our knowledge. But more and more I feel that a defective posture in youth is bound to be followed by degenerative trouble in later life due to malalignment of the synovial joints. Hence the need for spotting osteochondritis early and attempting to treat it to maintain good posture.

Maintenance of Mobility.—This and its corollary, physical exercises, have been stressed without any great success. But if mobility is to be aimed

at and to be retained, then surely this, again, is one of the weapons which we must put forward by propaganda.

Conclusion

Certain types of strain will always be with us. As Jamieson pointed out when discussing flexor strains at the Provincial Meeting at Cambridge, the chances of reducing such strains in country workers are very slight. But, on the whole, these are the class who give less trouble, their condition tending to improve or become quiescent independent of treatment. Perhaps as more and more labour-saving appliances come into use such strains will fall less and less on the spines of workers in all categories. At the same time, however, it is only fair to point out that in all probability their spinal muscles will show a corresponding loss of power through relative disuse.

In addition Butler's survey, already quoted, seems to incriminate overstrain in youth as a direct cause of osteochondritis. How is this to be controlled? Parliament already partially controls the work of youth. It cannot control its temperament, and if that leads to damage through overstrain then we shall have to accept it.

I hope I have started enough hares for discussion to follow, and that some of the later speakers will throw further light on various points that I have raised.

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WORLD CONFEDERATION FOR PHYSICAL THERAPY

SECOND INTERNATIONAL CONGRESS

THE Second International Congress of the World Confederation for Physical Therapy was held at the Statler Hotel in New York from June 17 to 23, 1956. It was attended by 2,073 physiotherapists from 34 different nations.

The Congress opened on Sunday morning with services at the Middle Collegiate Church and at the Monastery of St. Francis of Assisi. In the evening there was a reception, when all members and guests were received by Miss Elson, President of the World Confederation, and members of the Executive Committee.

Opening Ceremony

At the official opening ceremony the following morning, speeches of welcome were given by Miss Elson, the Commissioners of the New York City's Department of Health and the New York State Department of Health, and others, all of whom stressed that, in spite of the many different nationalities present and the many languages spoken, everyone had a common aim in the care and well-being of the patient. In her opening address Miss Elson spoke of the growth of the International Confederation and its close relationship to such bodies as the World Health Organization and International Poliomyelitis Congress. She gave some interesting figures of the number of physiotherapists in the member organizations, Great Britain having the greatest number, but Denmark the greatest number relative to the total population. At the close of her address she lighted a revolving globe of the world, the symbol of the Congress.

Scientific Sessions and Exhibition

During the rest of the week a series of lectures and papers were given by doctors and physiotherapists from many countries, covering a wide variety of subjects. Concurrently with these sessions professional and technical films were shown.

On the morning of Wednesday, June 20, an Educational Seminar was held at which 120 teachers discussed the training of physiotherapists in the underdeveloped countries and the ways in which the varying requirements could be met.

There was an extensive display of scientific and technical exhibits, at which all the latest forms of apparatus, publications, and teaching aids were shown and where members could also obtain information about such

organizations as the Arthritis and Rheumatism Foundation, training in physical therapy in various countries, and training in allied professions.

Social Programme

In the evenings a full programme of social events was arranged. On Monday the New York Chapter were hosts at a three-hour boat trip round Manhattan Island, and on the following evening the Canadian Physiotherapy Association gave a reception on the roof of the Waldorf-Astoria Hotel. The Banquet was held at the Statler Hotel on Wednesday, with Dr. Kessler as Master of Ceremonies, the guests being entertained by a dance recital given by the Modern Dance Group of the Texas State College for Women. On Thursday the International Society for the Welfare of Cripples sponsored a visit to the United Nations Headquarters, where visitors were welcomed by the Under-Secretary of the Department of Public Information.

Annual General Meeting

At the Annual General Meeting of the Confederation on Wednesday afternoon, Belgium, Holland, and Israel were admitted as member organizations, bringing the total to 15. Miss Griffin (Great Britain) was elected President, Miss Elson (United States) first Vice-President, Mrs. Agersnap (Denmark) second Vice-President, and M. Dupis-Delfour (France) third Vice-President. It was decided that the Third International Congress should be held in Paris in 1959.

Closing Ceremony

At the closing ceremony Mr. Donald Wilson, secretary of the International Society for the Welfare of Cripples, spoke on the expanding opportunities of the World Confederation. He emphasized the importance of keeping up with new developments, of maintaining ethical and professional standards, and of establishing effective international organizations. Mr. Basil O'Connor spoke on "The Progress through Lay and Professional Co-operation", and Dr. Hart E. Van Riper on the "Second Congress—What it has meant". Finally Miss Elson spoke of the growing relationship between physiotherapists from so many different countries and the value of such international gatherings, not only from the point of view of knowledge gained, but, even more important, for the opportunities for discussion and exchange of ideas.

The lighted globe was then dimmed and the Congress was over.

CLINICAL REPORTS

OSTEOCLASTOMA PRESENTING AS MONARTICULAR ARTHRITIS OF THE WRIST

THE following case is considered worthy of record because, although the clinical, radiological, and operative findings suggested a chronic infection of the lower end of the radius, histological examination revealed the presence of osteoclastoma.

Case Report

A male aged 29 years was referred to one of us (D. L. W.) on April 24, 1956, on account of pain in the left wrist of insidious onset. The pain was intermittent and had been present over the past three years, though it had become progressively worse. There were no other symptoms. His general health was good and general examination was satisfactory.

On examining the left upper limb an increase in temperature was noted over the wrist-joint; movements were restricted and painful, particularly on joint flexion. A small palpable swelling was present just above the styloid process of the radius. There was 1½ inches wasting of the left arm and 2½ inches of the forearm.

Investigations.—Blood count (24.4.56): haemoglobin 100%; leucocytes 8,000 per c.mm. (polymorphs 68%, lymphocytes 29%, hyalines 1%, eosinophils 2%); E.S.R. 2 mm. in one hour (Wintrobe). 9.5.56: Widal reaction negative; gonococcal complement-fixation test and Wassermann reaction negative.

Radiological Findings (Plate XVI).—Radiographs of the left wrist revealed an osteolytic lesion of about 1 cm. in diameter at the extreme lower end of the radius in an antero-medial situation. The bone surrounding the lesion appeared to be somewhat sclerosed. This sclerosis, taken into conjunction with the small size of the lesion and the duration of symptoms, suggested either a chronic infective process or an eosinophil granuloma in an unusual site. There was no X-ray evidence of disease of the lungs.

This case therefore presented as one of monarticular arthritis. In view of the radiological appearance and the negative results of laboratory investigations a tentative diagnosis of chronic abscess was made, and exploration of the lower end of the radius was decided upon.

Operation (*G. R.-J.*):*23.5.56.*—The lower end of the radius was explored through an incision on the anterior aspect of the wrist. On broaching the cortex of the lower end of the radius in the region of the lesion nothing specific was found apart from a certain amount of what appeared to be rather rotten and semi-necrotic cancellous bone. This was removed with a spoon until healthy cancellous bone was reached. The lesion had no definite limiting wall such as the radiograph had suggested. There was no fluid and no pus, but macroscopically there seemed no reason to doubt that this was a low-grade infective pro-

Radiograph of left wrist showing osteolytic lesion.

Showing spindle-cell growth with a few of the large multinucleate osteoclasts. (×360.)

cess. However, histological examination of a specimen of the tissue showed that it was "composed for the main part of plump spindle cells, interspersed with moderately numerous osteoclasts. There is considerable haemosiderosis. The histology is that of osteoclastoma." Plate XVII shows the spindle-cell growth with a few of the large multinucleate osteoclasts.

Discussion

The peculiarities of this case would appear to be that clinically, radiologically, and at operation there seemed to be no reasonable doubt that the patient was suffering from a chronic infection of the lower end of the radius, and it was only on microscopical examination that the true cause of the trouble was revealed.

With regard to subsequent treatment, it is hoped that the lesion has been completely ablated and will not recur. There would not seem to be any clear indication for radiotherapy at the present stage. Indeed, in the opinion of Cade, radiotherapy is not the treatment of choice in the young adult in sites where surgery offers a reasonable prospect of success. The use of radiotherapy in such patients introduces a very real risk of post-radiation osteogenic sarcoma as much as twenty years later.

Acknowledgments

Our thanks are due to Dr. Henry Caplin, Pathologist to the Connaught Hospital, for his assistance with the investigations and histological examination; also to Mr. J. E. Webster, of the Photographic Department of the Hospital, for the photographs.

G. Rigby-Jones
Douglas L. Woolf

Connaught Hospital,
London, E.17.

NEW APPLIANCES

CHAIR FOR A PATIENT WITH HIP DEFORMITIES

THE chair shown in Plate XVIII was designed for an artist with deformed, unstable knees and both hips ankylosed in extension, a result of Still's disease. He could neither sit nor stand. He could not paint satisfactorily supine, and had for some years worked propped against the end of a sofa, supported on his elbows and with his feet jammed against a cupboard to prevent them slipping along the floor. This was very fatiguing and restricted his arm movements. In this chair he sits with most of his weight on his buttocks, his back supported, and his arms free for working.

The construction can be seen in the photograph. The usual chair seat is replaced by a motor-cycle saddle fixed to an adjustable tubular steel mounting. This particular chair was made to measure in the Occupational Therapy Department for the patient referred to above, but adaptation of a suitable chair might be sufficient in other cases.

Acknowledgment

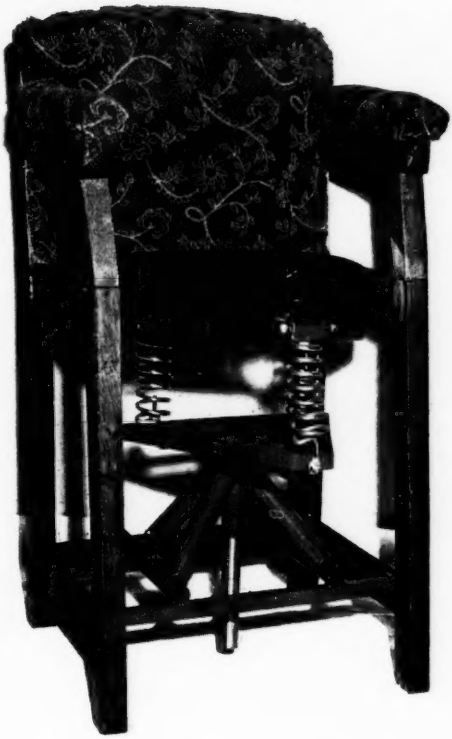
I am indebted to Mr. H. B. Pink, my occupational therapy technician, who designed and made the mounting for the saddle, and supervised the construction of the chair by the patients working in the department.

K. A. SOWDEN

St. Bartholomew's Hospital,
Rochester, Kent

DIPLOMA IN PHYSICAL MEDICINE

THE next course for Part I of the Diploma in Physical Medicine will begin at Guy's Hospital during the first week of January, 1957. Full particulars may be obtained from the Physics Department, Guy's Hospital Medical School, London, S.E.1.



Saddle-chair for patient with deformed hips.

BOOK REVIEW

Collagen Diseases. By J. H. TALBOT and R. M. FERRANDIS. Pp. 191. 46s. New York and London: Grune and Stratton. 1955.

THIS monograph is devoted to the rarer collagen diseases, including systemic lupus erythematosus, polyarteritis nodosa, dermatomyositis, systemic scleroderma, and thrombotic thrombocytopenic purpura. The common collagen diseases, rheumatoid arthritis and rheumatic fever, are only mentioned in the text with reference to differential diagnosis. Each disease is discussed separately in chapters which are subdivided into sections dealing with the historical aspect, aetiology, pathology, clinical findings, prognosis, and treatment. The production of the book is excellent, and it is printed on fine paper. There are 16 coloured plates, and a number of radiographs clearly illustrate soft-tissue and lung lesions. At the end of the book there is a bibliography with 540 references to papers selected from several thousand read by the authors. There is also a reliable index.

As the authors point out, the rarer collagen diseases present a challenge to the physician partly because their aetiology is unknown and their prognosis grave, and partly because they are no longer oddities, having become relatively common over the last two decades. This may be due to the fact that they are more frequently recognized, but there is some evidence that there has been an actual increase in incidence. While their aetiology is unknown, hypersensitivity to a number of allergens, including sulphonamides and antibiotics, has been suggested, and this might account for the increase.

The authors note that it is sometimes difficult to distinguish one collagen disease from another, and even patients with long-standing "rheumatoid arthritis" may later develop systemic lupus erythematosus or polyarteritis. Some patients are actually found at autopsy to have microscopical evidence of more than one collagen disease. Despite these findings and the pleomorphic nature of the diseases, the authors believe that an unequivocal diagnosis can be made if a case is followed up for a sufficient length of time, though they admit that a "sufficient length of time" may in some cases include a post-mortem examination. In the early stages of illness rheumatic fever or rheumatoid arthritis may be simulated. It is evident that the collagen diseases are eventually fatal despite steroid therapy, and specific treatment probably depends on discovering their aetiology. The recent awareness that hydrallazine produces an illness similar to systemic lupus erythematosus in a small number of patients treated for hypertension is therefore of great importance.

This book will be read with interest by all physicians concerned with the rheumatic diseases. They will want to keep it on a bookshelf for further reference, and, although it is highly priced, this is a reflection on the present value of money, for it is difficult to see how it could have been produced for less.

S. MATTINGLY

ABSTRACTS OF THE LITERATURE

Aminotripeptidase Content of Synovial Fluid in Arthritic Diseases. M. ZIFF, J. SIMSON, E. SCULL, A. SMITH, J. SHATTON, and D. MAINLAND. *J. clin. Invest.*, 1955, **34**, 27.

The authors observe that synovial inflammation leads to liberation of the enzyme aminotripeptidase into the synovial fluid. The degree of synovial inflammation may be measured by a leucocyte count of the fluid, but the results may be variable and often inaccurate. Therefore it is suggested that determination of aminotripeptidase activity may prove a more accurate and consistent measure of the amount of inflammation.

In this investigation the aminotripeptidase levels in effusions from a variety of arthritic diseases are compared, 98 patients with knee effusions being studied. Under ethyl chloride anaesthesia 112 samples of fluid were taken. (Procaine is a potent inhibitor of aminotripeptidase.) Determination was by the titrimetric method of Grassman and Heyde, with thymolphthalein as indicator, the substrate being glycylglycylglycine. The ranges of enzyme level (expressed as percentage hydrolysis per hour) were: degenerative joint disease, 1·4 to 6·9; rheumatic fever, 3·6 to 12·2; gonococcal arthritis, 5·7 to 0·3; gout, 3·3 to 46·2; rheumatoid arthritis, 3·3 to 56·3. The relatively low values observed in degenerative joint disease are in contrast to the higher and widely scattered values found in rheumatoid arthritis. In the rheumatoid group, of 42 samples taken, 8 gave values below 10%. The leucocyte count and aminotripeptidase levels were estimated in 45 samples, but only a moderate degree of correlation was found, thus indicating that the leucocyte count is not satisfactory for estimating enzyme level.

MAURICE F. HART

Rheumatoid Arthritis and Psoriasis. M. DE G. GRIBBLE. *Ann. rheum. Dis.*, 1955, **14**, 198.

The author confirms that psoriasis occurs in 3 to 4% of cases of rheumatoid arthritis. This is greater than the incidence of psoriasis generally, but he believes that the forms of arthritis which are accompanied by psoriasis are too variable to permit of the condition being designated "psoriatic arthritis" and regarded as an entity.

G. D. KERSLEY

Nature of Anaemia in Rheumatoid Arthritis. L. M. H. ROY, W. R. M. ALEXANDER, and J. J. R. DUTHIE. *Ann. rheum. Dis.*, 1955, **14**, 63.

The authors summarize the literature on the metabolism of iron in rheumatoid arthritis. Significant degrees of hypoferraemia in the presence of normal iron-binding was confirmed, but no evidence of impaired absorption of iron from the gut was found. The rate of removal of iron from the plasma after intravenous injection appeared to be more rapid in patients with rheumatoid arthritis than in normal individuals.

G. D. KERSLEY

Abstracts of the Literature

Cardiac Changes in Rheumatoid Arthritis. N. EGELIUS, O. GOHLE, E. JONSSON, and F. WAHLGREN. *Ann. rheum. Dis.*, 1955, **14**, 11.

The authors discuss the results of examination of the heart in 13 cases of rheumatoid arthritis coming to necropsy. They found no evidence suggestive of rheumatic-fever lesions or other significant changes other than pericarditis, which was present in 7 cases. They also carried out a careful clinical investigation in 100 cases of rheumatoid arthritis, comparing the results with those in 100 non-affected controls. Cardiac lesions were found in 8% of the cases of rheumatoid arthritis and in 7% of the controls, suggesting that endocardial or myocardial changes due to rheumatoid arthritis are, at all events, rare.

G. D. KERSLEY

Chronic Arthritis after Recurrent Rheumatic Fever. A. E. THOMAS. *Ann. rheum. Dis.*, 1955, **14**, 259.

Twenty-nine cases of recurrent rheumatic fever in which there was no doubt about the original diagnosis have been examined and the results analysed. This series was highly selected in that it comprised all patients attending Manchester Royal Infirmary between 1948 and 1953 on account of rheumatic conditions, who had previous rheumatic heart disease and who were available.

Thirteen of the cases appeared to have developed a rheumatoid syndrome, and the differential sheep-cell agglutination test was positive in 10 of these. Radiographs suggested rheumatoid arthritis, and the reaction to aspirin was of a grade such as is usually associated with rheumatoid disease.

Seventeen cases appeared to be suffering from true recurrent rheumatic fever. In 9 the attacks were invariably preceded by episodes of upper respiratory infection. Aspirin had an extremely marked effect in controlling pain and fever. Five cases showed considerable hypermobility of the metacarpo-phalangeal joints, producing ulnar deviation. In 8 there was gross limitation of movement of the lumbar spine, but in 3 of these where deep X-ray therapy was applied no symptomatic benefit accrued.

Radiographs of hands and feet in these patients did not reveal any erosions of the rheumatoid type. In one patient there was juxta-articular porosis only, and in two cases a curious alteration of the bone trabecular pattern in addition. Radiographs of the sacro-iliac joints showed complete fusion in one case. In 7 there were abnormalities unlike those usually seen in ankylosing spondylitis, consisting of very small erosions surrounded by spotty areas of sclerosis. The radiological changes in the spines consisted of irregularity and fusion of the interfacetal joints, narrowing of the intervertebral disks, increased height of the vertebral bodies, and some ossification in the disks—appearances which are unlike those of typical ankylosing spondylitis.

The differential sheep-cell agglutination test was negative in all the patients in this group. Antistreptolysin O titrations were performed in the hope that they might provide some evidence of continuing rheumatic activity when this was present. Todd (1932) and Swift (1952) have shown, however, that whilst high titres may be obtained in the early stages of an attack of rheumatic fever, the level falls rapidly as the illness proceeds and is usually normal during the inactive stages. The two patients with high titres in this group were both seen during an acute attack.

G. D. KERSLEY

Abstracts of the Literature

Heberden's Nodes. R. M. STECHER. *Ann. rheum. Dis.*, 1955, **14**, 1.

In this, the Heberden Oration for 1954, the author summarizes his views on Heberden's nodes. He believes the condition to be hereditary, dominant in women and recessive in men, with its onset in the female only at the menopause and afterwards. He considers that the condition has no relationship with osteoarthritis elsewhere, and that no treatment has any very great effect on it.

G. D. KERSLEY

Comparison of Cortisone and Aspirin in Treatment of Juvenile Rheumatoid Arthritis. B. M. ANSELL, E. G. L. BYWATERS, and I. C. ISDALE. *Brit. med. J.*, 1956, **1**, 1075.

This is a report of a Medical Research Council investigation into 25 cases of juvenile rheumatoid arthritis along the same lines as a previous one on adults (*Brit. med. J.*, 1954, **1**, 1223). Children under 16 with arthritis of less than nine months' duration were used in the trial, 13 being given cortisone and 12 aspirin. Clinical and functional improvement was similar in both groups, but among the children a greater number had improved at the end of one year than among the adults. In three patients cortisone was discontinued—in two because of lack of response associated in one with inconstant glycosuria; in the third because of osteoporosis and a fracture of the femur on falling out of bed 22 weeks after treatment was begun.

A. ZINOVIEFF

L'adrénalinethérapie du Dr Louis Moss de Londres dans le traitement du rhumatisme chronique. F. WICHTERMANN. *Rhumatologie*, 1954, **3**, 138.

Dr. Moss's adrenaline method of treating chronic rheumatism is described. Only excluding febrile and infective cases, the author's series of 163 cases treated by this method included everything from "lumbago without a disk lesion to osteoarthritis of the hip". In 151 cases symptoms were relieved in an average of 12 to 18 days (70% of the patients received less than six treatments). Nine cases relapsed.

[There are no clinical, radiological, or laboratory details of the cases treated, nor is the treatment given described in each case. There is no control series.]

J. F. BUCHAN

Metacortandracin and 9-alpha-Fluorohydrocortisone Acetate in Rheumatic Diseases. L. VILLA, C. B. BALLABIO, and G. SALA. *Ann. rheum. Dis.*, 1955, **14**, 251.

Both steroids produce a state of hypercorticoidism and inhibit adrenal function, "metacortandracin" causing a marked decrease in circulating eosinophils. Both have anti-rheumatic activity; metacortandracin is 3 to 5 times and 9-alpha-fluorohydrocortisone 8 to 10 times more potent than cortisone. The latter, however, has a strong mineralocorticoid effect and is, therefore, of little value in the treatment of rheumatic diseases. Metacortandracin has a negligible mineralocorticoid effect, but the glucocorticoid effect and the tendency to increase diabetes, gastric symptoms, etc., are similar to those of cortisone when administered in equivalent therapeutic dosage.

G. D. KERSLEY

Abstracts of the Literature

The Management of Surgical Treatment of Arthritis of the Hip. R. BROOMHEAD. *Physiotherapy*, 1955, **41**, 3.

In this paper from the General Infirmary at Leeds the author, after classifying the conditions which either cause or predispose to osteoarthritis in the hip-joint, describes the technique of arthroplasty by means of the vitallium mould or with an acrylic prosthesis. Of more interest, however, to the physical medicine specialist and physiotherapist is the detailed description of the after-care of the patient from his return to the ward to the time when he is able to walk without the help of crutches or sticks. Broadly speaking, this consists first of rest in bed with the operated leg placed in balanced suspension traction on a Thomas splint with traction to prevent flexion of the hip-joint, and in abduction and internal rotation according to the stability of the joint at the time of operation. Post-operative exercises begin as soon as the patient is fit enough. These consist of breathing exercises, gluteal and quadriceps contractions, and foot and toe movements of both limbs to be practised for ten minutes every waking hour.

After two or three weeks, exercises for the other hip and upper trunk movements are added. During the fourth week the Thomas splint is removed, the foot rests in a special boot with castors, and exercises on a board and slings are begun, followed by rotation exercises in the fifth week. In the sixth week the patient is allowed to sit up and to begin exercises in a Hubbard tank; and in the seventh week he is taught balance exercises in a walking-chair and on crutches.

Subsequent treatment consists of exercises in the Guthrie-Smith sling apparatus and on a stationary bicycle, walking with crutches on the flat and mounting stairs, then after six months walking with sticks, and finally without support.

The author concludes: "The exercises . . . have all been designed particularly for the vitallium-mould arthroplasty. If, however, an acrylic arthroplasty has been done the rate of progress is quicker, so that the patient can begin walking after three or four weeks . . . and discard his crutches after three or four rather than after six months."

L. D. BAILEY

Chondromalacia of the Patella. P. WILES, P. S. ANDREWS, and M. B. DEVAS. *J. Bone Jt Surg.*, 1956, **38B**, 95.

In this paper from the Middlesex Hospital and Bland Sutton Institute of Pathology the authors review the literature and discuss the incidence, natural history, pathology, and aetiology of chondromalacia patellae. They present new studies of 31 specimens removed at operation. The clinical signs are described in detail. Treatment is discussed, and the results in 46 patients treated by excision of affected cartilage or patellectomy are presented. Operation was undertaken in the presence of disabling symptoms.

The findings are summarized as follows: "Chondromalacia, sometimes a precursor of osteoarthritis, is present in the articular cartilage of the patella of most people by the age of thirty; it causes symptoms in only a few and it gives rise to osteoarthritis in fewer still. It may progress slowly or quickly, but there is no clinical method of assessing the prognosis at an early stage."

The authors point out that the diagnosis of chondromalacia patellae, both clinical and at operation, becomes more common as awareness of the condition increases.

[This is an impressive and authoritative review of a condition frequently met in physical medicine departments and rehabilitation units.]

P. J. R. NICHOLS

Diagnose, Symptomatologie und konservative Therapie vertebraler Krankheitsbilder. K. GUTZEIT. *Med. Klin.*, 1954, **49**, 1865.

Since the first operation for prolapsed lumbar disk was performed (Mixter and Barr, 1933) the vertebral column has begun to play a larger role in neurology. Myelography has shown that appearances at the height of an attack of sciatica do not differ from those seen during remission; nor can "death" of the nerve-root explain relief from pain, since recurrence is only too common. The explanation must lie in the vascular supply to the nerves, where tension or other changes can take place without being demonstrated by the means at our disposal.

The author strongly supports chiropractic theory and ascribes a variety of conditions to disorders of the vertebral column. The cervical region, for instance, gives rise to such conditions as Dupuytren's contracture, periarthritis humeroscapularis, Heberden's nodes, vertigo and Ménière's disease, trigeminal neuralgia, and anxiety states. The dorsal spine is incriminated in intercostal neuralgia and many gastric and intestinal disturbances. It is claimed that by palpation the skilled practitioner can detect slight vertebral displacement which may not be apparent on X-ray films. Traction and reposition are advised in treatment.

DAVID PREISKEL

The Value of Electrodiagnostic Methods in the Investigation of Neuromuscular Disease. J. N. WALTON. *Physiotherapy*, 1954, **40**, 76.

In this paper the author describes muscle testing by electrical stimulation. He mentions briefly what he calls the classical method, meaning thereby the demonstration of Erb's reaction of degeneration by the use of faradic and galvanic stimulation, and alludes to the myotonic and myasthenic responses.

The remainder of the paper is devoted to the "so-called strength-duration or intensity-duration curves" and to electromyography. A clear description is given of the apparatus in use and of the plotting of intensity curves, as well as of the method employed in recording by the electromyograph the action potentials arising in normal and pathological muscle and in neuromuscular conditions. The abnormalities detected in myographic tracings and sound recordings in certain neuromuscular conditions, such as peripheral nerve injury, diseases of the spinal cord and motor nerve roots, myelopathic lesions, and proximal and distal neuropathic lesions, are described and discussed, and the value of these tests is stressed.

The photographs and diagrams are clear and informative.

L. D. BAILEY

GENERAL INDEX

Abstracts of the literature, 28, 71, 114, 160
Actinotherapy, modern, review of book on, 70
Acupuncture, historical aspects, 94
American Congress of Physical Medicine and Rehabilitation, 1955 session, 61
Amplifiers, low-frequency, interference by diathermy machines, 59
Amputation, physical therapy after, review of book on, 69
Anxiety hysteria presenting as "tenosynovitis", 64
ARNOTT, D. C.: Report of first provincial meeting of B.A.P.M., 25
Arthritis, monarticular, of wrist, osteoclastoma presenting as, 156
——, rheumatoid, hydrocortisone by local injection in, 3
——, ——, juvenile, plastic splints in treatment, 9
——, traumatic, of elbow, hydrocortisone by local injection in, 6
Atelectasis after heart operations, breathing exercises and, 18

BARNETT, C. H., BOWDEN, Ruth E. M., and NAPIER, J. R.: Shoe wear as a means of analysing abnormal gait in males, 121
BARTER, R. W.: Unusual case of unilateral spastic weakness, 21
BASS, A. L.: Anxiety hysteria presenting as "tenosynovitis", 64
BAUWENS, P.: Medical use of light sources, 49
—— and STYLES, P.: Short-wave diathermy and radio interference, 55
Blistering, historical aspects, 91
Book reviews, *see* Reviews of books
BOWDEN, Ruth E. M., see Barnett, C. H., joint-author
Breathing exercises, effect on incidence of atelectasis after heart operations, 18
BRENNAN, J. B.: Plastic splints in treatment of juvenile rheumatoid arthritis, 9
BREWERTON, D. A.: Apparatus for increasing muscle strength, 99

BRITISH ASSOCIATION OF PHYSICAL MEDICINE:
1956 Annual Meeting, 107
—— —— ——, business meeting, 111
—— —— ——, clinical meeting, 110
—— —— ——, discussion on osteoarthritis, 143
—— —— ——, preliminary announcement, 26
—— —— ——, scientific programme, 107
First provincial meeting, Cambridge, 25

Carbon arc lamp *v.* quartz mercury vapour burner, 49
Cautery, historical aspects, 92
Cervical traction, adjustable head halter for, 67
Chair, Dingwall transit, Model 8, sliding back to, 24
—— for patient with hip deformities, 158
Circulation, peripheral, review of book on, 27

CLINICAL REPORTS:
Anxiety hysteria presenting as "tenosynovitis", 64
Osteoclastoma presenting as monarticular arthritis of wrist, 156
Spastic weakness, unilateral, unusual case, 21
Syringomyelia with multiple neuropathic joints, 103

Cold, exposure to, in rural workers, 46
Collagen diseases, review of book on, 159
Corset, lumbar, improved pattern, 105
Counter-irritation and gout, 96
——, electrical, historical aspects, 95
——, historical methods of, 90
COYER, A. B.: Review of *Peripheral Circulation in Man*, 27
Cripples, International Society for Welfare of, 7th World Congress, 106
Cupping, historical aspects, 90
CURWEN, I. H. M.: Review of *Modern Actinotherapy*, 70

General Index

Diathermy, short-wave, interference with low-frequency amplifiers, 59
——, ——, —— —— radio, 55
Dignan, J. F., obituary notice, 112
Dingwall transit chair, Model 8, sliding back to, 24
Diploma in Physical Medicine, course for Part I, notice, 158
Disabled, services for, review of book on, 27

Elbow, traumatic arthritis of, hydrocortisone by local injection in, 6
Electrical counter-irritation, historical aspects, 95
Electromyograph amplifier, transistor, 66
Epidemic, Royal Free Hospital, 81
Erythema, production by radiation, 51
Extension stresses in rural workers, 45

FELL, W. A.: Osteoarthritis, 150
Flexion stresses in rural workers, 41

Gait, abnormal, shoe wear as a means of analysing, 121
GEORGE, R. E.: A transistor electromyograph amplifier, 66
GLANVILLE, H. J.: Unit for early rehabilitation in a general hospital, 101
Gout, counter-irritation and, 96

Haemarthrosis, hydrocortisone by local injection in, 5
Harmonic radiations, 55
—— ——, suppression of, 57
Head halter, adjustable, for cervical traction, 67
Heart operations, atelectasis after, breathing exercises and, 18
Hip deformities, chair for patient with, 158
Hospital, general, unit for early rehabilitation in, 101
Hydrocortisone, local injection, 1
——, —— ——, side-effects, 6
——, —— ——, technique, 2
Hysteria, anxiety, presenting as "tenosynovitis", 64

Injuries by direct violence in rural workers, 46
Issues, historical aspects, 91

JAMIESON, E. S.: Some rural stresses, 41
Joints, neuropathic, multiple, syringomyelia with, 103

KENDALL, P. Hume: Use of hydrocortisone by local injection, 1
Knee, osteochondritis dissecans of, 13

LEVEAUX, V. M.: Review of *Physiotherapy in Paraplegia*, 113
LEWIS, N. R., and WHITE, P. K. B.: Osteochondritis dissecans of knee, 13
Light sources, medical use of, 49
—— ——, spectra of, 53
Lumbar corset, improved pattern, 105

MARTIN, G. M.: American Congress of Physical Medicine and Rehabilitation, 1955, 61
MASON, E. F., and SCOTT, B. O.: An improved lumbar corset, 105
MASON, R. M.: Osteoarthritis, 143
——: Report of 13th annual meeting of B.A.P.M., 107
MATTINGLY, S.: Reviews of *Collagen Diseases*, 159; *Services for the Disabled*, 27; *Textbook of Orthopaedic Medicine*, 112
Medicine, orthopaedic, review of textbook of, 112
——, physical, *see* Physical medicine
Mercury vapour burner *v.* carbon arc lamp, 49
Moxibustion, historical aspects, 93
Muscle strength, apparatus for increasing, 99

NAPIER, J. R., *see* Barnett, C. H., joint-author
Neuropathic joints, multiple, syringomyelia with, 103

General Index

NEW APPLIANCES:
Chair for patient with hip deformities, 158
Dingwall transit chair, Model 8, sliding back to, 24
Head halter, adjustable, for cervical traction, 67
Lumbar corset, improved, 105
Transistor electromyograph amplifier, 66

North and Midlands Physical Medicine Club, report of meeting, 40

OBITUARY:
Dignan, J. F., 112
Smart, Sir Morton, 68

Orthopaedic conditions, hydrocortisone by local injection in, 6
—— medicine, review of textbook of, 112
OSMOND-CLARKE, H.: Osteoarthritis, 150
Osteoarthritis, discussion at B.A.P.M. Annual Meeting, 1956, 143
——, hydrocortisone by local injection in, 4
Osteochondritis dissecans of knee, 13
Osteoclastoma presenting as monarticular arthritis of wrist, 156

Panoramic receiver, 56
Paraplegia, physiotherapy in, review of book on, 113
Physical Medicine, American Congress of, 1955 session, 61
—— ——, British Association of, *see* British Association of Physical Medicine
—— —— Club, North and Midlands, report of meeting, 40
—— ——, Diploma in, course for Part I, notice, 158
—— therapy after amputation, review of book on, 69
—— ——, World Confederation for, 2nd International Congress, 154
Physiotherapy in paraplegia, review of book on, 113
Plastic splints in treatment of juvenile rheumatoid arthritis, 9
Pot resonator, 58

Quartz mercury vapour burner *v.* carbon arc lamp, 49
QUINN, C. E.: Osteoarthritis, 149

Radiations, harmonic, 55
——, ——, suppression of, 57
——, production of erythema by, 51
Radio interference by short-wave diathermy, 55
Receiver, panoramic, 56
Rehabilitation, early, unit for, in a general hospital, 101
Resonator, pot, 58

REVIEWS OF BOOKS:
Collagen Diseases, by J. H. Talbot and R. M. Ferrandis, 159
Modern Actinotherapy, by R. H. Beckett, 70
Peripheral Circulation in Man (Ciba Foundation Symposium), 27
Physical Therapy after Amputation, by Margaret Bryce, 69
Physiotherapy in Paraplegia, by Elvira P. G. Hobson, 113
Services for the Disabled (Ministry of Labour and National Service), 27
Textbook of Orthopaedic Medicine, by J. Cyriax, 112

Rheumatoid arthritis, *see* Arthritis, rheumatoid
RICHARDSON, A. T.: Some aspects of the Royal Free Hospital epidemic, 81
RIGBY-JONES, G., and WOOLF, D. L.: Osteoclastoma presenting as monarticular arthritis of wrist, 156
Royal Free Hospital epidemic, 81
Rural stresses, 41

SAVILL, G.: Review of *Physical Therapy after Amputation*, 69
SCOTT, B. O.: Adjustable head halter for cervical traction, 67
——, *see also* Mason, E. F., joint-author

General Index

Setons, historical aspects, 91
Shoe wear, analysis of abnormal gait by, 121
Shoulder-joint lesions, hydrocortisone by local injection in, 5
Skin, defensive properties, 52
Smart, Sir Morton, obituary notice, 68
Society, International, for Welfare of Cripples, 7th World Congress, 106
SOWDEN, K. A.: Chair for patient with hip deformities, 158
Spectra of different light sources, 53
Splints, plastic, in treatment of juvenile rheumatoid arthritis, 9
STEINBERG, V. L.: Syringomyelia with multiple neuropathic joints, 103
STRANDBERG, B.: Incidence of atelectasis after heart operations with and without breathing exercises, 18
Stresses, rural, 41
STYLES, P., *see* Bauwens, P., joint-author
Synovitis, traumatic, hydrocortisone by local injection in, 5
Syringomyelia with multiple neuropathic joints, 103

Tenosynovitis, anxiety hysteria presenting as, 64
Traction, cervical, adjustable head halter for, 67
Transistor electromyograph amplifier, 66

WAND-TETLEY, J. I.: Historical methods of counter-irritation, 90
Weakness, spastic, unilateral, unusual case, 21
WHITE, P. K. B., *see* Lewis, N. R., joint-author
WOOLF, D. L., *see* Rigby-Jones, G., joint-author
Wrist, monarticular arthritis of, osteoclastoma presenting as, 156

ABSTRACTS SUBJECT INDEX

ACTH, *see* Corticotrophin
Adrenaline method of Dr. Moss in treatment of chronic rheumatism, 162
Allergic polyarthritis, 34
Aminotripeptidase content of synovial fluid in arthritic diseases, 160
Amputation in children, prostheses for, 80
—— —— elderly, rehabilitation after, 39
Anaemia in rheumatoid arthritis, nature of, 160
Anaesthesia, peridural, as a therapeutic method, 115
Analgesic properties of various drugs used in treatment, 114
Arthritis, aminotripeptidase content of synovial fluid in, 160
——, chronic, after recurrent rheumatic fever, 161
—— of hip, management of surgical treatment, 163
——, rheumatoid, anaemia in, nature of, 160
——, ——, clinical and necropsy findings, 30
——, ——, differential diagnosis, 29
——, ——, diphenylamine reaction in, 116
——, ——, heart changes in, 161
——, ——, juvenile, treatment by cortisone and aspirin compared, 162
——, ——, in males, 78
——, ——, plasma gamma globulin and joint tissue in, relation between, 117
——, ——, psoriasis and, 160
——, ——, treatment, medical and social aspects, 116
——, ——, —— by paraffin-wax baths, 116
——, ——, tri-ketocholanic acid in, 29
Aspirin in juvenile rheumatoid arthritis compared with cortisone, 162

Back, low, pain, treatment by manipulation, 36
Baker's cyst of knee, report of case, 79
"Benemid" and sodium salicylate treatment of gout, 32
Blood flow and radioactive sodium clearance in dog, relationship between, 71
—— supply of facial nerve, 73
Brace, cervical, 120
Brain palsy in childhood, 117
"Butazolidin," *see* Phenylbutazone

Calcification, para-articular, paraplegic, 76
Cartilage, diffuse inflammation of, 31
Cervical brace, 120
Chondromalacia of patella, 163
Climatic factors in disseminated sclerosis, 76
Corticotrophin treatment of post-traumatic dystrophy, 119
—— ——, prolonged, osteoporosis and compression fractures due to, 36
Cortisone in juvenile rheumatoid arthritis compared with aspirin, 162
—— treatment of post-traumatic dystrophy, 119
—— ——, prolonged, osteoporosis and compression fractures due to, 36
Creatine, urinary, in progressive muscular dystrophy, origin of, 74
Cyst, Baker's, of knee, report of case, 79

"Decholin" in rheumatoid arthritis, 29
Desensitization with aqueous extract of streptococci, rheumatic diseases treated by, 29
Diathermy, short-wave, in orthopaedics, 39
Diphenylamine reaction in rheumatoid arthritis, 116
Disk, intervertebral, *see* Spine
Dystrophy, muscular, progressive, origin of urinary creatine in, 74
——, post-traumatic, cortisone and ACTH treatment, 119

Elbow, surgical anatomy of, 119
Electrodiagnosis, value in neuromuscular disease, 164
Epitrochlear gland biopsy in diagnosis of synovial tuberculosis of hand and wrist, 114

Abstracts Subject Index

Facial nerve, blood supply of, 73
Felty's syndrome, treatment, 34
Flat-foot, peroneal spastic, 38
9-α-Fluorohydrocortisone acetate in treatment of rheumatic diseases, 162
Fractures, compression, from prolonged cortisone and corticotrophin therapy, 36
—— of head of radius, 119

Gamma globulin, plasma, and joint tissue in rheumatoid arthritis, relation between, 117
Ganglion, stellate, block, fatalities and complications, 76
Gout, sodium salicylate and probenicid treatment, 32

Hand, synovial tuberculosis of, diagnosis by epitrochlear gland biopsy, 114
Heart changes in rheumatoid arthritis, 161
Heberden's nodes, 162
Hip arthritis, management of surgical treatment, 163
——, cross-firing with diathermy in treatment, 39
——, osteoarthritis of, nature and evolution, 32
Hydrocortisone, intra-articular injection, in joint conditions, 78

Intervertebral disk, *see* Spine

Joint, *see also* Arthritis; Osteoarthritis
—— function, measurement and recording, 28
—— tissue and plasma gamma globulin in rheumatoid arthritis, relation between, 117

Knee-joint aspiration in diagnosis, 78
——, Baker's cyst of, report of case, 79

Labour, nerve injury during, paralysis of leg muscles due to, 118
Leg muscles, paralysis of, from nerve injury during labour, 118

Manipulation, treatment of low back pain by, 36
Membrane, serous, involvement by rheumatoid nodules, 30
Mercurialism, chronic, a cause of amyotrophic lateral sclerosis, 80
"Metacortandracin" in treatment of rheumatic diseases, 162
Moss's adrenaline method of treating chronic rheumatism, 162
Muscle, biceps, of dog, relationship between blood flow and radioactive sodium clearance in, 71
—— dystrophy, progressive, origin of urinary creatine in, 74
—— function, methods of measurement, 28
—— recovery in poliomyelitis, 73
Muscles of leg, paralysis from nerve injury during labour, 118

Nerve, facial, blood supply, 73
—— fibres, regenerating, branches formed by, 72
——, first sacral, incarceration in bony recess of spinal canal as cause of sciatica, 118
—— injury during labour, paralysis of leg muscles due to, 118
Nerves, tensile strength during healing, 72
Neuromuscular disease, value of electrodiagnostic methods in, 164
—— re-education, principles of, 73

Old age, amputation in, rehabilitation after, 39
Orthopaedics, short-wave diathermy in, 39
Osteoarthritis of hip, nature and evolution, 32
—— and spondylosis, possible relationship between, 118
Osteoporosis from prolonged cortisone and corticotrophin therapy, 36

Pain, linguistic problems in describing, 71
——, low back, treatment by manipulation, 36
——, shoulder, degenerative changes in rotator cuff and, 37
Palsy, cerebral, in childhood, 117
——, rifle-sling, 38

Abstracts Subject Index

Panchondritis, report of case, 31
Para-articular calcification, paraplegic, 76
Paraffin-wax baths in treatment of rheumatoid arthritis, 116
Paralysis, flaccid, differential diagnosis, 75
—— of leg muscles from nerve injury during labour, 118
Paraplegia, early management of patient with, 36
——, posture in, electromyographic studies, 120
——, statistical survey of 1,000 cases, 75
——, traumatic, initial treatment, 75
Paraplegic para-articular calcification, 76
Patella, chondromalacia of, 163
Peridural anaesthesia as a therapeutic method, 115
Peroneal spastic flat-foot, 38
Phenylbutazone, antithyroid effect, 31
——, assessment of value, 28
——, effect on uric acid metabolism, 30
—— in low dosage in rheumatic diseases, 79
Poliomyelitis, muscle recovery in, 73
Polyarthritis, allergic, 34
——, diagnosis, 29
Posture in paraplegia, electromyographic studies, 120
Prednisone in treatment of rheumatic diseases, 162
Probenicid and sodium salicylate treatment of gout, 32
Prostheses for juvenile amputees, 80
Psoriasis, rheumatoid arthritis and, 160
Pyrazolone derivatives, antipyretic properties, compared with salicylates, 114

Radius head, fractures of, 119
Re-education, neuromuscular, principles of, 73
Rehabilitation of elderly amputees, 39
Rheumatic diseases, classification, 29
—— ——, effect of phenylbutazone in low dosage, 79
—— ——, stress factors in aetiology, 77
—— ——, treatment by desensitization with aqueous extract of streptococci, 29
—— ——, —— with "metacortandracin" and 9-α-fluorohydrocortisone acetate, 162
—— fever, newer concepts in diagnosis and treatment, 78
—— ——, recurrent, chronic arthritis after, 161
Rheumatism, campaign against, in Sweden, 77
——, chronic, treatment by Dr. Moss's adrenaline method, 162
Rheumatoid arthritis, *see* Arthritis, rheumatoid
—— nodules involving serous membranes, 30
Rifle-sling palsy, 38
Rotator cuff, degenerative changes in, shoulder pain and, 37

Sacral nerve, first, incarceration in bony recess of spinal canal as cause of sciatica, 118
Sacralization, an aetiological factor in lumbar intervertebral disk lesions, 115
Salicylates, antipyretic properties, compared with derivatives of pyrazolone, 114
Sciatica, incarceration of first sacral nerve in bony recess of spinal canal as cause of, 118
Sclerosis, amyotrophic lateral, chronic mercurialism a cause of, 80
——, disseminated, local weather and, 76
Shoulder pain, degenerative changes in rotator cuff and, 37
Sjögren's syndrome, 34
Sodium, radioactive, clearance and blood flow in dog biceps, relationship between, 71
—— salicylate and probenicid treatment of gout, 32
Spine, cervical, brace for, 120
——, incarceration of first sacral nerve in bony recess of spinal canal as cause of sciatica, 118
——, intervertebral disk lesions, lumbar, diagnosis, symptomatology, and conservative treatment, 164
——, —— —— ——, ——, sacralization an aetiological factor, 115
——, —— —— ——, treatment, 35
——, —— —— syndrome, stress factors, 35
Spondylitis, ankylosing, 34
Spondylolisthesis, review based on 46 cases, 37

Abstracts Subject Index

Spondylosis and osteoarthritis, possible relationship between, 118
Stellate ganglion block, fatalities and complications, 76
Streptococci, aqueous extract, desensitization with, rheumatic diseases treated by, 29
Stress factors in disk syndrome, 35
—— in aetiology of rheumatic diseases, 77
"Suprachol" in rheumatoid arthritis, 29
Sweden, campaign against rheumatism in, 77
Synovial fluid, aminotripeptidase content in arthritic diseases, 160
—— membrane of hand and wrist, tuberculous infection of, diagnosis by epitrochlear gland biopsy, 114

Tendon, extensor, at wrist, spontaneous rupture of, 80
Thyroid, inhibition of uptake of radioactive iodine by phenylbutazone, 31
Tri-ketocholanic acid in rheumatoid arthritis, 29
Tuberculosis, synovial, of hand and wrist, diagnosis by epitrochlear gland biopsy, 114

Ultrasonics, experience of 3,000 treatments, 40
Uric acid metabolism, effect of phenylbutazone on, 30

Vertebrae, block, 35

Weather, local, and multiple sclerosis, 76
Wrist, extensor tendons of, spontaneous rupture of, 80
——, synovial tuberculosis of, diagnosis by epitrochlear gland biopsy, 114

ABSTRACTS AUTHOR INDEX

ACHENBACH, W., 34
ADAMS, F. H., 78
ADDISON, N. V., 80
ADKINS, E. W. O., 37
ADRIAM, J., 76
AITKIN, G. T., 80
ALEXANDER, W. R. M., 160
ALLEN, I. M., 117
ANDERSON, E., 34
ANDREW, J., 115
ANDREWS, P. S., 163
ANSELL, B. M., 162
ARMATO, A., 117

BALLABIO, C. B., 162
BATCH, J. W., 28
BAYLES, T. B., 117
BENEDICT, J. D., 74
BLOCKEY, N. J., 38
BLUNT, M. J., 73
BRACHMAN, P., 117
BROOMHEAD, R., 163
BROWN, I. A., 80
BYWATERS, E. G. L., 162

CAMERON, B. M., 79
CECCHI, E., 116
DE COEK, N., 116
COHEN, E. B., 36
COONRAD, R. W., 38
COYER, A. B., 36
CUDKOWICZ, L., 30, 34
CURWEN, I. H. M., 36
CYRIAX, J., 35

DESCHAUER, A., 115
DEVAS, M. B., 163
DIAL, N. A., 71
DUTHIE, J. J. R., 116, 160

EDSTROM, G., 77
EGELIUS, N., 161
EISENSTADT, W. S., 36
ELLMAN, P., 30, 34
ELWOOD, J. S., 30, 34

FAVOUR, C. B., 117
FEARNLEY, G. R., 116
FERRARIS, F., 116
FLETCHER, W. B., 116
FRANTZ, C. H., 80

GOHLE, O., 161
GOLDTHWAITE, J. G., 117
GRIBBLE, M. de G., 160
GUTTMAN, L., 75
GUTZEIT, K., 164

HARDENS, H., 31
HARRIS, R., 116
HARRISON, M. H. M., 32
HART, F. D., 34
HARTFALL, S. J., 77
HIGHTON, T. C., 29
HOPKINS, C. E., 76
HUDDLESTON, O. L., 73

ISDALE, I. C., 162

JONSSON, E., 161

KALINSKY, H. J., 74
KELLY, M., 28, 79
KUIPERS, R. K. W., 78

LA BARRE, J., 114
LACKNER, R., 116
LANGDALE-KELHAM, R., 39
LEVITT, S., 114

MCGEHEE, F. O., 79
MCNAMARA, J. G., 120
MAINLAND, D., 160
MARSON, F. G. W., 32
MASON, M. L., 119
MEANOCK, R. I., 116
MELZAC, J., 120
MIALL, W. E., 78
MILLARD, J. B., 116
MOISE, R., 29
MORGANS, M. E., 31
MUKHERJEE, S. R., 72
MUNTZ, H. H., 38
MURCHISON, R. A., 38

NORING, O., 119

OCHSNER, A., 76
OLSSON, O., 37

PAABY, H., 119
PARMLY, J., 76
PIRKIS, J., 116
PONTERIO, F. V., 71
PRENTICE, T. C., 71

ROBINS-BROWNE, R., 40
ROY, L. M. H., 160
RUSK, H. A., 36
RYLE, G., 71

SALA, G., 162
SALTER, N., 28
SANDIFER, P. H., 75
SCARRONE, L. A., 74
SCHAJOWICZ, F., 32
SCHLESINGER, P. T., 118
SCOTT, B. O., 39
SCOTT, J. C., 35
SCULL, E., 160
SHARRARD, W. J. W., 73
SHATTON, J., 160
SHAWE, G. D. H., 72
SIMON, M., 35
SIMSON, J., 160
SMALL, J. C., 29
SMALL, J. C. jun., 29
SMITH, A., 160
STAHL, R. R., 71
STECHER, R. M., 162
STOLLBERG, G., 34
STOREY, G., 76
STOTT, F. D., 120
STRETTON, De W., 74
SWANK, R. L., 76

TEGNER, W. S., 76
THOMAS, A. E., 161
THOMPSON, M., 116
TREICHLER, J., 118
TROTTER, W. R., 31
TRUETA, J., 32

VAUGHAN, J. H., 117
VILLA, L., 162

WAGENSEIL, W., 120
WAHLGREN, F., 161
WALTON, J. N., 164
WEIR, M. M., 116
WERTHEIM, A. R., 74
WICHTERMANN, F., 162
WILES, P., 163
WOOD, H. L. C., 118
WYNGAARDEN, J. B., 30

ZIFF, M., 160